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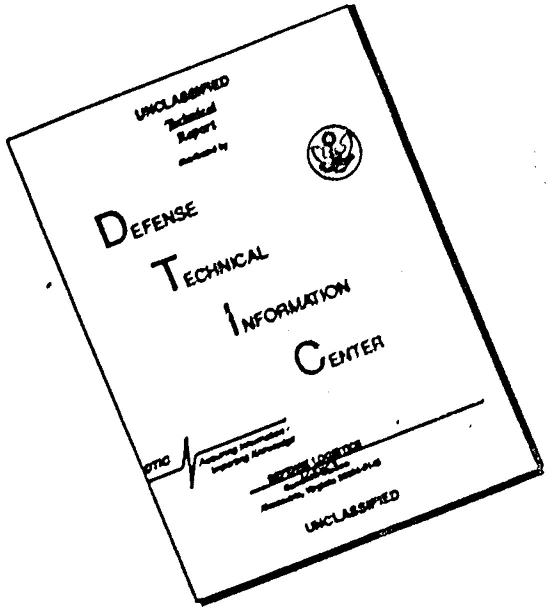

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SECURITY CLASSIFICATION OF THIS PAGE AD-A193345

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Distribution Unlimited/ Approved for Public Release
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) SAPEO-CDE-IS-87006	5. MONITORING ORGANIZATION REPORT NUMBER(S) SAPEO-CDE-IS-87006
6a. NAME OF PERFORMING ORGANIZATION Ofc of the Prog Executive Officer Prog Mgr for Cml Demil 6b. OFFICE SYMBOL (If applicable) AMCPEO-CDM	7a. NAME OF MONITORING ORGANIZATION Ofc of the Prog Executive Officer Prog Mgr for Cml Demil
6c. ADDRESS (City, State, and ZIP Code) Bldg. E4585, Edgewood Area Aberdeen Priving Ground, MD 21010-5401	7b. ADDRESS (City, State, and ZIP Code) Bldg. E4585, Edgewood Area Aberdeen Proving Ground, MD 21010-5401
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Ofc of the Prog Exec Officer - Prog Mgr for Cml Demil 8b. OFFICE SYMBOL (If applicable) AMCPEO-CDM	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N/A
8c. ADDRESS (City, State, and ZIP Code) Bldg E4585, Edgewood Area Aberdeen Proving Ground, MD 21010-5401	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
Chemical Stockpile Disposal Program Monitoring Concept Study (U)

12 PERSONAL AUTHOR(S) B. A. Kuryk, R. G. Roux, W. R. Brankowitz, K. J. Flamm, P. M. Owens, L. C. Rowe, W. F. Spurgeon, T. W. Thomas, C. F. Whyne

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM Nov 86 TO Sep 87	1987 September 10	62

16. SUPPLEMENTARY NOTATION

17. COSATI CODES		
FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Chemical Weapons, Chemical Munitions, Monitoring, GB, VX, HD
Chemical Demilitarization

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This report presents the monitoring concepts for all aspects of the Chemical Stockpile Disposal Program. The chemical agent monitoring standards and equipment are described and their application to storage, handling, transport and disposal of chemical agents and munitions is discussed. The report describes the monitoring and control of the disposal process conditions (e.g., temperature, pressure, etc.) as a means of ensuring safe plant operations. Industrial pollutant monitoring is also covered. Organizational monitoring and control concepts are described for all aspects of the program.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL BARBARA A. KURYK	22b. TELEPHONE (Include Area Code) (301) 671-4505 22c. OFFICE SYMBOL AMCPEO-CDM

DD Form 1473, JUN 86 Previous editions are obsolete. SECURITY CLASSIFICATION OF THIS PAGE

CHEMICAL STOCKPILE DISPOSAL PROGRAM
MONITORING CONCEPT STUDY

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10 September 1987

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LIST OF ACRONYMS

ACAMS	Automatic Continuous Air Monitoring System
AOC	Army Operations Center
ASC	Allowable Stack Concentration
CAM	Chemical Agent Monitor
CAMDS	Chemical Agent Munition Disposal System
CFR	Code of Federal Regulations
CSDP	Chemical Stockpile Disposal Program
DAAMS	Depot Area Air Monitoring System
DDESB	Department of Defense Explosives Safety Board
DFS	Deactivation Furnace System
DHHS	U.S. Department of Health and Human Services
DOD	Department of Defense
EP	U.S. Environmental Protection Agency Extraction Procedure
EPA	U.S. Environmental Protection Agency
FSA	Army Materiel Command Field Safety Activity
GB	Isopropylmethylphosphonoflouridate or Sarin
GOCO	Government Owned Contractor Operated
GPL	General Population Limit
H	Bis(2-chloroethyl)sulfide or Levinstein Mustard (75% purity)
HCl	Hydrogen Chloride
HD	Bis (2-chloroethyl)sulfide or Distilled Mustard (95% purity)
HL	High Level
HT	Mixture of Bis(2-chloroethyl)sulfide (60%) and Bis(2(2-chloroethylthio)ethyl)ether (40%)

LIST OF ACRONYMS

IDLH	Immediately Dangerous to Life and Health
IST	Integrated Systems Training
JACADS	Johnston Atoll Chemical Agent Disposal System
LASH	Lighter Aboard Ship
LIC	Liquid Incinerator
LLRR	Low Level Rapid Response
MAC	Military Airlift Command
MPF	Metal Parts Furnace
MTMC	Military Traffic Management Command
NAAQS	National Ambient Air Quality Standards
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NSPS	New Source Performance Standards
PAS	Pollution Abatement System
PCB	Polychlorinated Biphenyl
PEO-PM Cml Demil	Program Executive Officer-Program Manager for Chemical Demilitarization
PHA	Preliminary Hazard Analysis
POHC	Principal Organic Hazardous Constituent
PSD	Prevention of Significant Deterioration
QA	Quality Assurance
QC	Quality Control
SAR	System Safety Analysis Report
SHA	System Hazard Analysis

LIST OF ACRONYMS

SOI	Surety and Operational Inspection
SOP	Standard Operating Procedure
T	Bis(2(2-chloroethylthio)ethyl)ether
TEAD	Tooele Army Depot
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
VOST	Volatile Organic Sampling Train
VX	o-Ethyl, S-(2-diisopropylaminoethyl)methylphosphonothiolate

SECTION 1

INTRODUCTION

Monitoring is the timely collection and analysis of information to determine the state of a process or the environment. This report outlines the monitoring concepts, general procedures, and instrumentation that will be used in implementing the Chemical Stockpile Disposal Program (CSDP). The fundamental objective of the monitoring program is to protect occupational and public health and the environment by ensuring control of the program. The purpose of this document is to address monitoring in sufficient conceptual detail to support the CSDP Programmatic Environmental Impact Statement. The monitoring of the lethal chemical agents GB, VX, and mustard, wastes generated in the disposal system, the process controls, and the administrative controls is described conceptually.

This report does not attempt to depict the specific individual monitors, controls, and alarms that will be used during program implementation or the specific locations of such devices. Rather, the report describes the kinds of instrumentation that will be used, the type of information the instrumentation will provide, and how that information will be used by program personnel, regulatory groups, and oversight bodies.

The scope of the monitoring concept plan is intended to cover all major aspects of monitoring involving the Chemical Stockpile Disposal Program. This includes providing information on (1) the state of the environment before operations commence, (2) the process conditions throughout operations, (3) the amount and type of any material released during operations, and (4) any effects resulting from any and all activities associated with the program. Program activities include storage, handling, on- and off-site transportation, plant operations and plant closure.

Information obtained from monitoring will be used to ensure that disposal operations are being conducted properly and to detect any conditions which may cause or are causing an unanticipated release of chemical agent. During such conditions, monitoring data would be used to: (1) initially alert the operators to the problem, (2) provide quantitative data to the decision makers for responding to and solving the problem, and (3) predict impacts that might be anticipated from the release, if any.

To be useful, monitoring information must be from instruments selected to measure the proper parameters at correct locations. Measurements must be taken at intervals designed to ensure that useful information will be available in a timely fashion. The instruments used to measure any given parameter should be sufficiently sensitive to reliably measure threshold quantities. Less sensitive instruments may not provide sufficient confidence that the values are indeed below the critical level. Unreliable instruments may initiate unwarranted actions. Instruments used in this program will include instrumentation specifically developed by the Army to monitor chemical agents and commercial instrumentation to monitor other parameters (e.g., industrial pollutants). Specific instrument characteristics for agent monitors are provided where possible in this report. Standard state-of-the-art instrumentation is used for monitoring process parameters such as temperature and flow rates.

Selection of monitoring locations is also critical to a useful monitoring program. Locations must be representative points in the area of concern, either within the disposal process or in the vicinity of the disposal facility. Locations for ambient air monitors will be selected to provide optimum information. Process monitors will be at locations selected to correctly determine the state of the disposal process, using sound engineering judgment. Rationale for the selection of specific instrument locations for the parameters of interest is noted throughout this report.

To be useful in evaluating operations, monitored information must be obtained in a timely fashion. Instrument response times for agent monitoring are noted throughout this report. Process control sensors for temperature, pressure, and flow are real-time instruments.

Monitored data, required as a condition for operation by regulatory agencies, will be used to verify compliance with established standards and conditions of operations. These data will be obtained from specified instruments, taken according to approved methods, and reported in a format required by the facilities' environmental permits. These data are legal documentation and must meet rigorous quality control standards. Standards for data to verify compliance are routine for many emission facilities and must be clearly stated in the air quality, hazardous waste, and other permits or licenses required by the state for each disposal site. The Army will comply with all Department of Health and Human Services (DHHS) and Environmental Protection Agency (EPA) requirements, as well as state and local requirements.

Monitored data will vary due to different functions performed during stockpile disposal operations. Monitoring during storage will alert program personnel to problem munitions and containers (e.g., leakers) requiring remedial packaging. Monitoring of off-site transportation munitions packages will similarly alert program personnel regarding the integrity or loss of chemical agent munition or container containment and indicate the magnitude of a breach. With such information, program personnel can determine what actions need to be taken to regain containment and/or minimize the threat of agent exposure to workers and the public. Plant operations will rely on the process data to ensure that the process is proceeding as anticipated. Verification of controls and acceptable operations will enhance public confidence in continued operations. If an accidental release does occur, emergency response personnel will use monitoring data to determine the level of threat posed by the release, initiate emergency actions, and verify the effectiveness of measures to eliminate the problem.

The monitoring systems to be employed at each of the CSDP sites must meet specific preset standards to verify both the operability of the instrumentation and the level of training of the analyst/operator. This process is referred to as certification. Quality control standards will be used to verify continued high levels of analytical quality during the progress of the program.

The following chapters describe conceptually how the general goals described above are to be accomplished.

SECTION 2

AGENT MONITORING

2.1 INTRODUCTION

Since the inception of the chemical agent and munition demilitarization program, safety has been a vital element of every project or operation. A chemical agent monitoring system has been a key component of every demilitarization system. Because lethal chemical agents are currently stored and handled at eight chemical stockpile storage locations, an extensive network of agent detectors and monitors is employed at these sites during all agent operations. The goal of agent monitoring is to ensure the protection of the workers, the surrounding community and the environment.

Throughout the history of the chemical demilitarization program, several types of instruments have been employed for the purpose of: (1) verifying compliance with all applicable stack agent emission standards; (2) verifying compliance with all applicable work area agent standards; (3) providing rapid warning of potentially hazardous conditions; (4) ensuring that decontaminating procedures are complete; and (5) documenting ambient conditions surrounding the disposal site. The requirements for these systems are: the ability to reliably measure very low level concentrations of agent, the ability to reliably and rapidly measure high concentrations of agent, and the ability to document the concentration of agent detected.

2.2 STANDARDS FOR AGENT EXPOSURE

Air exposure limits for the agents of interest are presented in Table 2.1. These are safety standards which have been established by the Departments of Defense and in some cases the DHHS, and serve as guidelines for monitoring and locating monitors and detectors throughout the chemical demilitarization plants, the storage areas, transport activities and on the perimeter of the installation. The exposure limits are defined as:

IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH)

The IDLH is an agent concentration as defined by the Standards Completion Program (SCP) of the National Institute for Occupational Safety and Health (NIOSH) for the purpose of establishing respiratory protection guidelines. This concentration represents the maximum level of agent from which one could escape within 30 minutes without any "escape-impairing" symptoms or any irreversible health effects.

TIME WEIGHTED AVERAGE (TWA)

The TWA is the allowable unmasked worker exposure limit established by the Army and approved by the Department of Health and Human Services (DHHS) for an 8-hour/day exposure averaged over a maximum of five consecutive work periods for an indefinite time. A worker exposed to this concentration of agent over

TABLE 2.1

AGENT EXPOSURE LIMITS

STANDARD	CONCENTRATION (mg/m^3) GB	MUSTARD	VX
IDLH	0.2	0.4	0.4
TWA	0.0001	0.003	0.00001
GPL	0.000003	0.0001	0.000003
ASC	0.0003	0.03	0.0003

this time period will not suffer any health effects.

GENERAL POPULATION LIMIT (GPL)

The GPL is the allowable time weighted average agent exposure limit established for the general public for a 72-hour time period. A person exposed to this concentration of agent over this time period will not suffer any health effects.

ALLOWABLE STACK CONCENTRATION (ASC)

The ASC is the allowable concentration of agent that can be emitted at the stack. The primary purpose of the ASC is to establish a stack emission limit well below concentrations of agent that would result in any harm to personnel or the environment and at the same time would allow corrective action to be taken in a timely manner.

The agent exposure limits given in Table 2.1 are set conservatively and provide a safety margin to protect workers and the public health. However, in the cases of the ASC's for mustard and VX, technical considerations (i.e., limitations in monitor sensitivity) influence the limits. When detectors or instruments with greater sensitivity become available, these agent exposure limits may be lowered.

2.3 GENERAL APPLICATIONS OF AGENT MONITORING

The CSDP encompasses three principal activities: (1) storage; (2) handling and transport, and (3) disposal plant operations. Agent monitors will be used to detect safe conditions during the conduct of these activities. Generally two types of detectors have been used in the demilitarization program. These detectors can be classed as either automatic devices or historical monitors. The significant difference between the two classes of detectors is that the automatic devices are set to provide a quantitative readout of agent concentration and/or to alarm if a specified concentration of agent is detected, while the historical monitors sample an area to collect agent over a predetermined period of time. The automatic devices have been used to measure IDLH, TWA, and ASC levels. The historical monitors have been used to measure TWA, ASC, and GPL values. The historical monitors have also been used to collect archival data in process and ambient areas.

High-Level (HL) monitors are automatic devices that are capable of detecting the IDLH levels of agent, as well as agent levels below the IDLH. Low Level Rapid Response (LLRR) monitors are automatic devices that are capable of detecting TWA or ASC levels of agent. Historical monitors are devices that are used to document agent concentrations in operational areas, as well as in ambient locations surrounding the disposal site.

Table 2.2 gives typical locations for placement of the various monitors. Several criteria are used to determine monitor locations. Foremost of these is the risk of exposure. The risk of exposure at any location is dependent upon the following conditions: (1) the probability that agent will be present at concentrations in excess of established limits; (2) the nature of the source of

TABLE 2.2

GENERAL APPLICATIONS OF AGENT MONITORS

LOCATIONS OR APPLICATIONS	TYPES OF AGENT MONITORS: HIGH LEVEL	LOW LEVEL RAPID RESPONSE	HISTORICAL
STACKS			
Furnaces	X	X	X
Ventilation Filter		X	X
Brine Evaporator			X
PLANT WORK AREAS			
Adjacent to Agent Process Areas	X	X	X
Not Adjacent to Agent Process Areas		X	X
TOXIC AREAS	X		X
AMBIENT AREAS			
Installation Perimeter			X
Storage Yard	X	X	X
SUPPORT AREAS/ ACTIVITIES			
Life Support Air Line		X	X
Laboratory		X	X
Decontaminating Showers	X		
TRANSPORT ACTIVITIES	X	X	X

agent (e.g., continuous or intermittent, frequent source versus an infrequent source); and (3) the probability that people are present in the area. Other criteria that are considered only in applicable situations include the level of protective clothing worn by workers in the area, the physical configuration of adjacent areas, the presence or configuration of a ventilation system, the sensitivity and response time of the monitor, and finally the characteristics of the particular agent of concern.

2.3.1 Demilitarization Plant

Several generic agent monitoring applications will occur at the plant site. Referring to Table 2.2, the locations or activities discussed below must be monitored.

Stack monitoring can be subdivided into three areas. The areas that must be monitored are furnace stacks, ventilation filter stacks and brine evaporator stacks. The furnace stacks are monitored with LLRR, HL and historical monitors.

The ventilation system filters ensure containment of all airborne contamination within toxic enclosures. Each filter unit contains a filter train and a motor/blower. The filter train consists of prefilters, high efficiency particulate air (HEPA) filters, and activated charcoal filters, followed by a second bank of charcoal filters and a second bank of HEPA filters. Sampling ports are provided between the two banks of charcoal filters and in the exhaust stack. The monitor between the two banks of charcoal is used to determine when the agent collection efficiency of the first filter bank has degraded below acceptable levels. When this occurs, air flow is diverted to a stand by filtration system while the carbon filtration media are replaced in the original filter unit. The filter stacks are monitored with a LLRR and historical monitors.

The brine evaporator stack is monitored with a historical monitor.

Plant Work Areas can be subdivided into two categories. These categories are: areas adjacent to toxic process areas and areas not adjacent to toxic process areas. Areas adjacent to toxic process areas are monitored with HL, LLRR and historical monitors. Areas not adjacent to toxic process areas are monitored with historical and LLRR monitors.

Toxic Areas are monitored with HL and historical monitors. The monitoring of toxic areas is usually conducted on a case by case basis.

Support Areas/Activities are those activities or locations in the plant which do not fit neatly under the categories listed above. Life Support System (LSS) monitoring and the monitoring of the decontaminating procedure in the showers are two such examples. The LSS air line is monitored with a LLRR and a historical monitor. The decontaminating showers are monitored with a HL monitor. The Laboratory is a prime example of a support area for the demilitarization plant. The Laboratory is monitored with LLRR and historical monitors.

A more detailed discussion of disposal plant monitoring follows in Section 2.6.4.

2.3.2 Ambient Areas

The monitoring of ambient air was conducted in the early days of the demilitarization program to provide a positive check on the ambient air quality at the perimeter of chemical demilitarization plant sites. Ambient area monitoring now covers two activities. These activities are: perimeter monitoring and monitoring of storage yard activities.

Storage Yard Monitoring is a routine element of current chemical agent stockpile storage activities. Additionally the preparation of munitions for transport to a off-site transport packaging/loading area or to a demilitarization plant will require monitoring. Activities in the storage yard include entry into the storage area and any packing or repacking of munitions which must be done. Storage Yard monitoring involves the use of HL, LLRR and historical monitors. These detectors could be used separately or concurrently. The Storage Yard monitoring is placed under the Ambient Area Monitoring category because some of the monitoring to support activities in the storage yard is done outside of a storage structure. (Storage yard monitoring is discussed in detail in Section 2.6.2).

Installation Perimeter Monitoring continues to provide the demilitarization program a permanent record of ambient air quality which is used to demonstrate compliance with air quality standards. The perimeter monitoring network is not intended for process control, and it is not connected on a real time basis to a central location. This network provides a historical record that agent or industrial pollutants, as appropriate have not been detected at the installation boundary. Historical monitors will be used for agent perimeter monitoring. (Installation perimeter monitoring is discussed in detail in Section 2.6.5).

2.3.3. Transport Activities.

The monitoring of transport activities will involve the use of HL, historical and LLRR monitors. There are several functions which must be performed before munitions can be transported, including the packaging of munitions. Munitions will be checked for agent leakage with monitors before they are packaged, and the package interiors will be monitored for the presence of agent at scheduled transportation stops and when they reach their destination. (Agent Monitoring during transport activities is discussed in further detail in Section 2.6.3.).

The specification of an agent monitor for any particular location or activity is based ultimately on the protection of people and the environment and the potential magnitude of an accidental agent release at that location.

2.4 AGENT MONITORING INSTRUMENTATION AND EQUIPMENT

Agent monitoring is accomplished by using a combination of instruments and sampling systems. Automatic detectors are devices that give an alarm, a quantitative readout or both. Some automated instruments are capable of rapidly responding to high levels of agent (i.e., the IDLH standard). Others are capable of responding rapidly to relatively low levels of agent. Historical monitors typically are sampling systems that collect agent. The sampling systems usually consist of an agent collecting device (i.e., an impinger or solid sorbent tube) which has been strategically located to sample the air in an area for a predetermined period of time. The agent concentration is determined using an analytical instrument (e.g., a gas chromatograph) positioned in the laboratory.

The following air quality monitors will be used in monitoring transport activities, storage, and plant demilitarization operations: (1) Automatic Continuous Air Monitoring System (ACAMS); (2) Real Time Monitor (RTM); (3) M8A1 Alarm; (4) M8 Alarm; (5) Bubbler Absorption System; (6) Depot Area Air Monitoring System (DAAMS); and (7) Chemical Agent Monitor (CAM). The ACAMS is an automated device that will be used for HL or LLRR detection of agents GB, VX, or mustard. The RTM can be used for LLRR detection of agents GB or VX; however, because this monitor is susceptible to interferences and is not capable of monitoring mustard, it will find limited, if any, application in the CSDP. The M8A1 Alarm will be used for HL detection of agents GB or VX. The M8 Alarm is the forerunner of the M8A1 and it is also used for HL detection of agents GB or VX. The bubbler absorption system can be used for low level detection or to quantitatively establish the concentrations of agents GB or mustard. The bubbler absorption system will also be used to confirm alarms. The DAAMS will be used for low level detection and documentation of GB, mustard or VX concentrations. The CAM can be used to detect high levels of GB, VX, or mustard. The CAM is a British made instrument. As these monitors are improved or new technology is developed, the CSDP monitoring concept will be revised accordingly.

Table 2.3 gives the response times to IDLH levels for the HL detectors used in monitoring for GB, VX, and mustard. Table 2.4 gives the response times of the LLRR instruments used for monitoring TWA levels of the various chemical agents. Table 2.5 lists the sampling times of the historical monitors used in detecting agents GB, VX, and mustard at TWA, ASC, and GPL levels. These agent monitors will be discussed individually.

2.4.1 ACAMS

The ACAMS can detect GB, VX, or mustard at either IDLH, TWA, or ASC levels. It is an automated gas chromatograph which first collects agent on a solid sorbent tube and then thermally desorbs the agent into a separation column for analysis. The detection of the components eluting from the column is by a flame photometric detector, which can respond to either phosphorus (i.e., GB and VX) or sulfur (mustard) containing compounds. A fluorinating filter must be used for the detection of VX. A direct readout, in units of the exposure limit, is given on the front panel of the instrument. A permanent trace of the chromatogram is given on the strip chart recorder. An audible and visual alarm are provided within 2 min for IDLH applications and within 8 to 22 minutes for TWA applications. An alarm signal and an analog signal which can be converted to concentration units, can be wired to a remote control center. The ACAMS requires environmental protection from extreme heat, cold, and dust in order to function properly. This device can detect agent in a furnace

TABLE 2.3

HIGH LEVEL AGENT DETECTORS

DETECTORS	RESPONSE TIME TO IDLH LEVELS (MINUTES)
GB	
ACAMS	2.0
M8A1 Alarm*	0.2
M8 Alarm*	1.0
CAM*	1.0
VX	
ACAMS	2.0
M8A1 Alarm*	0.2
M8 Alarm*	3.0
CAM*	1.0
Mustard	
ACAMS	2.0
CAM*	1.0

* The M8A1 and the M8 Alarms cannot be used for stack monitoring due to their sensitivity to pollutants.

TABLE 2.4

LOW LEVEL RAPID RESPONSE DETECTORS

DETECTORS	RESPONSE TIME* TO TWA LEVELS (MINUTES)
GB	
ACAMS	8
RTM	12
VX	
ACAMS	22
RTM	12
Mustard	
ACAMS	8

* Response times for the ACAMS to ASC levels of agent range from 12 to 22 minutes.

TABLE 2.5

SAMPLING TIMES OF HISTORICAL MONITORS

SAMPLING SYSTEM	AGENT EXPOSURE LIMIT	SAMPLING TIME* (HOURS)
GB		
Bubbler	TWA	2.0
	ASC	1.0
	GPL	12.0
DAAMS	TWA	2.0
	GPL	12.0
VX		
DAAMS	TWA	2.0
	GPL	12.0
Mustard		
Bubbler	TWA	2.0
	ASC	1.0
DAAMS	TWA	2.0
	ASC	1.0
	GPL	12.0

* An analysis time of about 1 hour is required after sampling.

exhaust stack, a filter stack or in ambient air. The ACAMS does not sample continuously because sampling is stopped during the thermal desorption step. Sampling is conducted during 80 to 85 percent of the total cycle time for TWA monitoring and during 25 percent of the 2 minute cycle time for IDLH monitoring.

2.4.2 Chemical Agent Monitor

The Chemical Agent Monitor (CAM) is a fully portable, hand-held field instrument used for high level detection of either GB, VX, or mustard. The CAM operates on the principle of ion mobility. The CAM provides a visual display that is indicative of the amount of agent present. The response time is about one minute. The CAM is a British device and many of the technical features of this instrument are classified.

2.4.3 M8 Alarm

The M8 Alarm is a fully portable field monitor used for high level detection of GB or VX. The M8 Alarm is not reliable for mustard detection. The M8 detects nerve agent using an electrochemical cell. A fluorinating filter must be used for the detection of VX. The M8 Alarm's response time decreases significantly as the concentration of agent increases. In most demilitarization applications the M8 alarm is set to alarm if the IDLH level has been detected. The M8 Alarm's signal can be wired to a remote control center. The M8 Alarm does not require an environmental shelter, but this device is not designed to sample furnace exhaust (stack) gases for agent.

2.4.4 M8A1 Alarm

The M8A1 Alarm is an updated version of the M8 system which provides improved response time and easier maintenance. This sensor detects agents GB and VX by the use of an ionization cell. The M8A1 is not reliable for mustard detection. This detector's signal can also be wired to a remote control center. The M8A1 Alarm is not designed to sample furnace exhaust (stack) gases for agent.

2.4.5 Real Time Monitor

The Real Time Monitor (RTM) is an instrument used for continuous low level detection of GB or VX agent in ambient air or furnace exhaust gas. It consists of a wetted-wall sample tube, colorimetric analyzer, and a strip chart recorder. Any nerve agent present is absorbed from the sampled air or stack gas and concentrated in the liquid film that runs along the inside wall of the sampling tube. This liquid then enters a colorimetric analyzer where an enzyme and other reagent solutions are added. The presence of nerve agent reduces the color of the enzyme system in proportion to the concentration of nerve agent present. The concentration of nerve agent being sampled is indicated on a recorder trace. Audible and visual alarms are set off when the intensity of color falls below a preset level. A remote alarm can also be wired to a remote control center. The RTM also requires environmental protection. The RTM's analytical system will require modification for mustard detection because mustard does not give reliable results with the colored enzyme system. Additionally, the RTM is susceptible to interference by non-agent compounds.

2.4.6 DAAMS

The DAAMS employs a solid sorbent through which sampled air is drawn. The agent is adsorbed on the sorbent and is subsequently analyzed in the laboratory by a gas chromatograph equipped with a flame photometric detector. The DAAMS uses an analytical system that is very similar to the system employed in the ACAMS. The DAAMS is capable of detecting GB, VX, or mustard at TWA, ASC, or GPL concentrations. The laboratory results are usually available one hour after the specific sampling period is completed.

2.4.7 Bubbler Absorption System

The Bubbler Absorption System is capable of detecting low levels of GB or mustard in air and stack gas. The sampled stream (i.e., air or stack gas) is first drawn through a liquid contained within an impinger. The impinger or bubbler is then taken to the laboratory where the liquid is analyzed for GB by the colored enzyme system, and by colorimetric analysis for mustard. The laboratory results are usually available one hour after the specific sampling period is completed. The target agent exposure level (i.e., TWA, GPL, or ASC) determines the duration of the sampling period. The lower the agent concentration the longer the sampling period.

2.4.8 Other Agent Monitoring Equipment

Most of the agent monitoring that is performed in connection with demilitarization operations involve sampling air or gaseous streams. In some cases it might be necessary to sample liquids. Qualitative sampling for the presence of high levels of GB, VX, or mustard in a field environment can be performed with Chemical Agent Combat Detector Kits. These kits can include a hand-operated aspirator bulb, detector tickets, detector tubes, detector paper, and reagents. Air is drawn through a detector ticket or tube. When the ticket or tube has been treated with reagent solution, an immediate color change is observed if agent vapor is present. For liquid sampling, the detector paper is put in direct contact with the unknown liquid. A specific and immediate color change is used to confirm the presence of agent. This paper is designed to detect agent in liquid form.

2.4.9 Future Developments

The Army has a significant ongoing research and development program to improve agent monitoring capabilities through increased reliability, specificity, or shorter response times. One effort is seeking to improve the performance of the LLRR ACAMS by improved recognition of the chemical species with capillary chromatography, while at the same time reducing the overall response times from the current 8 to 22 min to 3 to 5 min. Another effort is under way to evaluate methods of detecting agent in incinerator stack gas with response times on the order of 15 seconds or less using tandem mass spectrometry. In line with the programs already mentioned, a major effort is ongoing to improve mustard monitoring capabilities with the major emphasis on lowering the mustard detection limits.

The CSDP will incorporate developments in detection capability as they become available.

2.5 MONITOR PERFORMANCE AND VERIFICATION

An overriding requirement for the design and development of monitoring systems has been the necessity for reliable day-to-day performance. Reliability, in this context, relates to the ability of the monitor to perform its intended function when called upon to do so. Additionally, successful demonstration of precision and accuracy in measuring agent concentrations in a laboratory setting is required before a system is even considered for testing and use in more severe field conditions.

Acceptance of new or improved agent monitors requires a deliberate systematic program. The chemical agent monitoring systems are subjected to extensive precision and accuracy testing in the actual monitoring environment. For example, instruments are tested by adding known amounts of chemical agents while concurrently sampling air from plant work areas, the furnace stack gases, and ambient locations (perimeter). This testing allows the evaluation of the sampling systems in a field environment to account for the effects of interferences or other phenomena associated with the sampling media. If the instruments perform reliably during this testing, these instruments are next set up to monitor concurrently with already proven monitors during actual agent operations. A successful performance during an actual agent operation is the final factor in deciding whether an instrument is ready to be an agent detector in the chemical demilitarization program.

The precision and accuracy testing demonstrates the operational characteristics of each monitoring system over a range of deliberately invoked agent concentrations and specified time periods. This information is used to ensure that the chemical agent exposure limits can be monitored with the required degree of confidence by each of the systems. The precision and accuracy test reports evaluating the effectiveness of each method are subject to independent review and inspection by the DHHS, Center for Environmental Health, and NIOSH.

Testing allows the Army to assess the reliability of the instrument and to assess the kinds and the amount of maintenance necessary to keep the device operating. Finally, testing helps the Army determine the worker's response and reaction to the instrument.

Once monitoring systems have been approved for storage, transport activities, or plant demilitarization operations, ongoing quality assurance procedures are initiated to ensure continued validity of the measurements. Laboratory instruments (used to analyze agent samplers) are calibrated each work shift. Daily agent testing of field sampling equipment such as impingers or DAAMS tubes is accomplished by adding a known amount of agent directly into the sampling device. This will verify that the required degree of precision and accuracy is maintained throughout operations. The automated monitors are also tested. Many of the critical monitoring stations (such as process stacks) have both automated agent detectors and historical monitors. This dual system of detectors not only helps the Army to document monitoring results but also serves to confirm the presence of agent or the performance of the instrument.

Advanced automated agent monitoring instrumentation, such as the ACAMS, is provided with internal diagnostics to determine the operability of the system.

The ACAMS software checks various parameters (e.g., temperatures, flow rates, etc.) to determine whether these parameters are outside preset limits. If outside these limits, an error message appears on the front panel. Additionally, a malfunction status signal is sent to the control center.

2.6 MONITORING STRATEGIES

2.6.1 Overview

During the disposal of the chemical weapons stockpile, storage, handling, transportation and disposal activities will be performed. For each of these activities, the monitoring strategy will be different. There are, however, some common denominators.

All activities will use low-level, high-level and historical monitors for chemical agents. In addition, all functions involve intensive monitoring at the source (e.g., next to the chemical weapons) and of the work area surrounding the chemical weapons. All use the same chemical agent standards, and actions to be taken in the event a standard is exceeded will incorporate standard operating procedures to respond to the problem. In summary, the air monitoring missions are: (1) to detect and measure local high level agent threats to workers immediately on the scene, and (2) to detect and measure low level agent concentrations as a means of preventing low level agent exposure of operators or the public.

The current storage monitoring techniques are a result of many years of successful storage with no record of public exposure. The techniques proposed for monitoring during transport are improvements partially based on past movement experiences, as described in the Chemical Weapons Movement History Compilation. The techniques proposed for disposal are a function of the disposal of over 16 million pounds of lethal chemical agents at Rocky Mountain Arsenal and at Tooele Army Depot during which no agent release has ever resulted in exposure to the public. The disposal experience of the Army is more fully described in the Chemical Agent and Munitions Disposal, Summary of the U.S. Army's Experience.

2.6.2 Storage Monitoring

2.6.2.1 Purpose

Storage monitoring is performed to detect chemical agent leaking from defective chemical weapons or containers. In most cases such leaks are from pin-sized holes and are referred to as "vapor leaks", although "liquid leaks" from failed welds or serious corrosion are also detected, albiet less frequently. The monitoring is conducted for the dual purpose of protecting the public and for protecting workers who are performing surveillance and maintenance on the chemical weapons.

2.6.2.2 Procedures for Monitoring Storage Structures or Areas

The Army divides monitoring of storage structures into two general categories. The first is GB filled M55 rocket igloos, and the second is routine monitoring of the remainder of the stockpile. GB filled M55 rockets are singled out for special attention due to the higher frequency of leakage as compared to the rest of the stockpile, as discussed in the Independent Evaluation/Assessment of Rocket, 115-mm: Chemical Agent (GB or VX), M55, October 1985.

GB Filled M55 Rocket Monitoring. M55 rockets were produced during the 1960's in groups known as lots. Each M55 rocket shares, for all intents and purposes, identical characteristics with other rockets in the same lot. This is particularly important as regards the agent fill. During one short period of manufacture, certain lots of M55 rockets were filled with GB that was not stabilized as well as the remaining items. (Note: A chemical stabilizer was added to GB to prevent formation of free acid and to retard corrosion of munition containers. This stabilizer is not the same as propellant stabilizer which is discussed elsewhere in the CSDP Programmatic Environmental Impact Statement). This group of items has leaked far more frequently than the remaining GB M55 rockets. These rockets have been designated as leaker lots, and amount to about two percent of the GB filled M55 rockets. These rockets have been segregated into separate igloos. For all leaker lots of GB filled rockets, daily low level monitoring of each storage structure is accomplished. For the remaining (98 percent) rocket lots, weekly low level monitoring will be performed.

Remaining Stockpile Monitoring. The remaining items of the stockpile contain GB, VX and HD. These agents are all liquids, although they differ in having different rates of vaporization. GB vaporizes rather readily and is primarily a vapor threat. Mustard vaporizes in warm environments, but is largely a liquid threat. VX does not readily vaporize and is almost entirely a liquid threat. Due to their different physical and chemical properties (e.g., vaporization rates, molecular structures, etc.), sampling times vary somewhat as shown in Tables 2.3, 2.4 and 2.5.

These items of the stockpile consist of a variety of projectiles, land mines, bombs, bulk containers and VX filled M55 rockets. Each is sampled in accordance with the type of agent it contains.

For the items containing VX, the Army will continue quarterly low level sampling for VX. This is principally due to the relatively low hazard that a VX spill presents in a storage structure. The hazard zone created by such a spill only extends several feet even in the event of a very serious spill.

For the items containing HD, the Army will initiate monthly low level sampling of storage structures and areas. This recognizes that the vapor pressure of HD is somewhat higher than that of VX, but is still considerably less than that of GB.

For the remaining items containing GB, the Army will initiate weekly low level sampling in line with the non-leaking lots of M55 rockets. This recognizes the serious vapor threat of GB, but also recognizes that these munitions are essentially sound and do not represent a problem like the M55 leaker lots.

2.6.2.3 Procedures for Entering and Working in Storage Structures and Areas

The Army uses an approach known as first entry monitoring to enter a storage structure. The Army must periodically conduct surveillance of the weapons to ensure security and to assess the condition of the munitions. The Army also periodically conducts maintenance to keep the munitions in good condition over a long period of time. Some examples of maintenance would be repalletizing items whose wooden pallets have termite damage or repainting munitions that show signs of surface rust. Maintenance can be done either in the storage structure or area, on the storage structure apron or by moving the weapons or containers to a chemical maintenance facility inside the excursion area.

First entry monitoring involves two principal steps. In the first step, individuals dressed in full protective clothing enter the igloo with high level alarms. The high level alarms are placed in the front and the rear of the igloo. Then as the second step a careful visual check for leaking liquid is made of all the munitions in the igloo. Once this check has been made successfully, the igloo is considered cleared for other personnel to enter. Working personnel are dressed to provide a level of protection commensurate with the job they are to perform. While this work is in progress, the high level alarms are left running where they were positioned, and sampling for low level quantities is conducted. If workers are to work unmasked, the high level alarms must be supplemented with low level monitors.

At Pine Bluff Arsenal, Tooele Army Depot and Aberdeen Proving Ground, one ton containers filled with mustard are stored in open storage areas. These areas are surrounded by security fencing and are constantly guarded. Procedures to enter these areas are essentially the same as those described above for entering storage structures.

2.6.2.4 Procedures for Monitoring the Storage Yard

In addition to monitoring of storage structures and monitoring for surveillance/maintenance, the Army will monitor the storage yard perimeter. This will provide an early warning of a potential release which had eluded the monitoring of individual structures, for instance a leak between the weekly monitoring periods.

The Army will position these monitors at key points throughout the storage yard. The key points will be identified for each installation based on that particular installation's storage yard layout, wind directions in that locality, and other local environmental factors. In all cases these monitors would be placed either inside the storage yard or at its boundary. The monitors would sample for GB, HD and VX except at locations where only one of these agents is present (e.g., Aberdeen Proving Ground - HD only, Newport AAP - VX only, Pueblo Army Depot Activity - HD only).

2.6.3 Transportation Monitoring

2.6.3.1 Purpose

Transportation monitoring is performed before, during and after movement. The monitoring is conduced for the purpose of: (1) protecting workers who are loading, escorting and unloading the munitions and (2) protecting the public at the loading and off-loading sites and along the transportation routes.

2.6.3.2 Loading for Transportation

Prior to loading, the storage structure or area selected for work will undergo first entry monitoring as described in Section 2.6.2.3. Once the storage structure or area had been cleared, low level samplers and higher level monitors will be placed in the work area at the igloo apron. The sampling and monitoring of the igloo described in section 2.6.2.3 will also continue.

The workers will then remove munitions from the igloo or area and will load them into a special insulated overpack for transportation. There are two different overpacks - one for on-site transportation and one for off-site transportation. Both types of packages will be leak tested prior to being placed in service. Once the overpack has been sealed, the munitions will be transported on-site to a disposal plant or to a holding area for off-site transportation. Items taken to the disposal plant will not be monitored enroute as the distances are short.

The off-site transportation package is specially insulated and provides redundant protection against the escape of contained gases. The package consists of an inner vapor-tight cylinder surrounded by a second vapor-tight cylinder. The cylinder-within-a-cylinder is enclosed in a vapor-tight shipping box of standard dimensions. The package, thus, has three areas that can be sampled through remote sampling ports: (1) the package cavity, in which the munitions are placed, (2) the airspace between the two cylinders, and (3) the vapor space between the outermost cylinder and the shipping container wall. At the holding area, each package cavity will be sampled prior to loading the shipping container onto the off-site transport vehicle. If leaks are detected during this time, the package will be transported to a chemical maintenance facility for isolation and removal of the defective munition. The defective munition will be removed and overpacked. The remaining good munitions will be decontaminated and replaced into the transportation package, and then will be returned to the holding area. The overpacked defective item will be set aside for shipment with other similar items in another package.

When a vehicle (train, truck, or aircraft, lighter) has been prepared for loading, the packages will be moved from the holding area to the vehicle. Prior to departure, the package cavity will be monitored a final time to ensure no leaking munitions are present at the start of the trip.

2.6.3.3 Off-site Transportation

Just prior to departure, a check will be made to ensure all special insulated containers are properly loaded, braced and secured. Each special container also is equipped with a thermocouple that monitors the munition cavity temperature. A check will be made to ensure that this thermocouple is hooked up and is relaying data to the appropriate monitoring panel.

During transportation, the temperature of the container will be monitored continuously for any signs of an unusual temperature rise. Response to an unusual temperature rise inside of a container, in the unlikely event that this happens, will be a responsibility of the escort team.

Also during transportation, agent monitoring will be conducted as described below according to transportation mode.

Rail. According to the Power Brake Law (49 CFR 232) planned stops will be made at intervals of not more than 1,000 miles for crew changes and normal train inspections. These stops will be made at locations selected to minimize proximity to population centers. At each stop the Army will pre-position low level monitors so that the special insulated containers can be monitored. Each container will be monitored by sampling air from the outermost airspace of the container. Sufficient monitors will be provided so that all monitoring can be completed in a timely fashion.

In the event a leak from the munition cavity to the outermost package airspace is detected, the escort team and the checkpoint team will cooperate to remove the package from the train and place it into another larger overpack container. These overpack containers and special handling equipment will be transported with each train convoy. This overpack container will then be placed on the train and the move will continue.

Air. During an air move of munitions in the protective packages, the airspace in the cargo bay of aircraft will be sampled continuously with a low level monitor. In the event agent leakage is detected, the aircraft will be diverted to a preselected emergency airfield. Protective gear will be immediately donned by all aircraft personnel.

Upon arriving at the emergency airfield, appropriate actions will be taken to clear an area so that the special insulated container can be removed from the aircraft and loaded into an overpack container. Monitors will be used to verify the success of all overpacking and decontamination. The overpack container will then be reloaded into the aircraft and the flight will continue.

Marine Transport. During the movement of mustard one-ton containers by ship, the one-ton containers packaged into special insulated containers will be stored in barges known as lighters. These lighters in turn will be hoisted aboard a special vessel called a Lighter Aboard Ship (LASH) vessel and will be stored in the vessel's cargo holds.

For the ship movement, each engine room of the LASH vessel will have two low level monitors. Each of the six cargo holds will also have two low level monitors. These will be run continuously and will alarm in the event agent leakage is detected.

In addition, each lighter will be sampled daily for mustard and the results verified in an on-board laboratory. In the event agent is detected, the

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For the ship movement, each engine room of the LASH vessel will have two low level monitors. Each of the six cargo holds will also have two low level monitors. These will be run continuously and will alarm in the event agent leakage is detected.

In addition, each lighter will be sampled daily for mustard and the results verified in an on-board laboratory. In the event agent is detected, the lighters will be equipped with access ports so that decontaminant can be added, and the leaking item and other contaminated portions of the lighter can be decontaminated.

2.6.3.4 Unloading from Transportation

After arrival at the destination, the special insulated containers would be removed to a holding area. Upon arrival at the holding area, the munition cavity of each container would be checked by a low level monitor to verify the presence or absence of agent in the munition cavity. Leakers will be sent to a facility for processing.

If no leak is detected, the special insulated container will be removed by truck to the toxic storage yard. When the truck arrives at the intended storage igloo, the munition cavity of the container will be sampled again using a low level monitor. Once again, if agent is detected, the item will be diverted to the maintenance facility. If no agent is detected, the special insulated container will be opened, the munitions will be removed and the munitions will be placed into storage. Storage monitoring will be resumed in accordance with Section 2.6.2. The empty containers will be reused in continuing movement operations to minimize the number of containers required, and therefore minimize movement costs.

2.6.3.5 Unloading at the Disposal Facility

For those items to be moved on-site from storage to the disposal plant, no monitoring enroute is planned based on the integrity of the on-site transportation package. The packages, upon arrival at the disposal facility will be moved to a temporary storage area prior to processing.

Once processing has been started, the containers will be moved to a package unload area. Here, prior to opening, the package cavity will be sampled for agent. If the innermost package cavity is not contaminated, the container will be opened, the munition pallet removed and items will be handled according to normal plant processing procedures. If agent is detected, the container will be moved to a toxic unload area specifically designed for this purpose. Here personnel in DPE suits will open the special insulated container, remove the leaking pallet and will take appropriate actions to introduce the leaking item to the processing line in a safe manner. The area will subsequently be decontaminated. A monitor will be used in this room to measure agent concentrations.

2.6.3.6 Monitoring of Spills Enroute

During any aspect of transportation - loading, transit or unloading - spills can occur. The installation response teams as well as the transportation escort teams will be equipped with the standard Army high level fast response monitor, detector tubes and detector paper. These items will be employed in the process of responding to and verifying cleanup of an accidental spill.

2.6.4 Disposal Plant Monitoring

2.6.4.1 Purpose

The proposed CSDP disposal plants are designed to prevent the release of chemical agents to the environment. Although careful design of process instrumentation/controls and ventilation systems and specification of proper operating procedures limit the risk of agent exposures to negligible levels, the possibility of an accidental exposure or release can not be ruled out completely. Thus a network of chemical agent alarms and samplers will be used in the proposed disposal plants to alert plant operators of unsafe conditions. The specific purpose of these instruments is to:

- Verify compliance with the applicable work area and stack emission standards listed in Table 2.1;

- Detect process upsets before a hazardous situation develops, thus allowing corrective actions to be taken; and

- Provide verification of the safety of the operation.

2.6.4.2 Methodology

Four chemical agent alarms and sampling systems will be used in the proposed CSDP disposal plants: (1) High Level ACAMS; (2) Low level ACAMS; (3) Bubbler Absorption System; and (4) DAAMS. The ACAMS will serve as the chemical agent alarms, notifying plant operators of process upsets as well as potentially hazardous conditions. With respect to work area monitoring, the Low Level ACAMS is configured to prevent chronic level exposures, whereas the High Level ACAMS is configured to prevent acute exposures. The Bubbler Absorption System or DAAMS will be used to provide a historical record of agent concentrations and to confirm ACAMS alarms. In addition, the Bubbler Absorption System or DAAMS will be used to determine the agent concentration in toxic process areas.

Except for the ACAMS used to monitor personnel and equipment in the airlocks connecting Toxic Process Areas and Non-Toxic Work Areas, all ACAMS will be continuously monitored by a status indicator panel in the plant control room. In the event agent is detected, an alarm will sound in that area and a signal will be instantaneously transmitted to the control room which will activate a visual and audible alarm. The local alarm alerts operators to wear their protective masks and take proper action as outlined in preapproved standard operating procedures (SOPs). The detector system will also be interfaced with the control room computer to provide a permanent record of the date, time and location of any alarm signal.

The specific application of the alarms and samplers described above is dependent on: (1) the potential for and magnitude of agent exposure; (2) probability that personnel will be present in the area; (3) the level of protective clothing worn by workers in the area; (4) the physical configuration of adjacent areas; and (5) the ventilation system configuration. Table 2.6 shows the overall approach that will be used in the proposed disposal plants and is based on the monitoring plan developed for the Johnston Atoll Chemical

TABLE 2.6

DISPOSAL PLANT MONITORING SCHEME

AGENT HAZARD OF CATEGORY	AREA DESCRIPTION (EXAMPLE)	TYPE OF CONTAMINATION	FREQUENCY AND TYPE OF MONITORING	SPECIFIC MONITORS
A	Toxic Process Areas (Explosive Containment Rooms, Munitions Processing Bays, Toxic Cubical, etc.)	Probable Liquid and Vapor Contamination	Initial Entry Survey to show Agent Levels	Bubbler or DAAMS
B	Toxic Process Areas (Incinerator Rooms)	Possible Vapor Contamination Only	Initial Entry Survey to show Agent Levels	Bubbler or DAAMS
C	Non-Toxic Work Areas Adajacent to Category A or B Areas (Observation Cooridors; Unpack Area)	Not Expected, but low level vapor contamination possible.	Continuous Low Level Rapid Response Alarm; Low Level Long Term for Documentation.	Low level ACAMS and Bubbler or DAAMS. High Level ACAMS also used in Unpack Area
D	Non-Toxic Work Areas (DPE Support Work Area)	Considered Uncontaminated	Continuous Low Level Rapid Response Alarm; and Low Level Long Term for Documentation	Low Level ACAMS an Bubbler or DAAMS
E	Control Romm (Positive Pressure Filtered Air Supply)	Not Contaminated.	Continuous Low Level Long Term for Documentation	Bubbler or DAAMS
Stacks	Incinerator, Filter and Brine Dryer Exhaust Stacks	Low Potential for Contamination	Continuous Low Level Rapid Response Alarm; Low Level Long Term for Documentation.	Low Level ACAMS and and Bubbler or DAAMS. No Low Level ACAMS required for Brine Dryer Stack.
Filters	Mid Bed Space Between Carbon Absorbers	Contaminated only after agent breakthrough	Periodic with Low Level Rapid Response Alarm.	Low Level ACAMS.

Agent Disposal System (JACADS).

<u>Toxic Process Area Monitoring.</u> Toxic Process Areas are designated "A" or "B" and are potentially contaminated with liquid or vapor agent, respectively. These areas contain the portions of the chemical agent/munition disposal process where the munition or container is disassembled, drained or transferred to an incinerator; where the agent is temporarily stored until incinerated, or where primary incineration occurs. Access to these areas is limited to personnel dressed in protective clothing. Therefore, agent monitoring need only be performed when access is required. Monitoring surveys will be performed prior to entry to ensure that ambient agent standards for personnel dressed in protective clothing are not exceeded. In addition, an initial monitoring survey will be performed for each agent type to establish an operational data base. Sampling ports for these areas will be installed in the walls between the Toxic Process Areas and the adjacent category "C" (see below) areas. Bubblers or DAAMS tubes will be used to perform this monitoring.

<u>Non Toxic Work Areas.</u> Areas designated as "C" category are adjacent to Toxic Process Areas and included the Unpack Area where the munitions are removed from their shipping or storage container and enter the disposal process, and the observation corridors where plant operators can observe the activities that are ocurring in the Toxic Process Areas (except the Explosive Containment Rooms). These areas have a low probability of contamination due to an accidental agent release but are usually occupied by unmasked workers. All category "C" areas are continuously monitored by a Low Level ACAMS and a Bubbler or DAAMS tube. In addition, the Unpack Area and Toxic Maintenance Area are monitored by a High Level ACAMS that will alarm in the unlikely event that workers are exposed to an acute agent dose.

Areas designated as "D" category are considered to be uncontaminated. This includes all work areas in the Munition Demilitarization Building (MDB) which are not located adjacent to a Toxic Work Area. Low Level ACAMS and Bubblers or DAAMS will monitor these areas to ensure worker safety.

The Control Room, designated category "E", is maintained under positive pressure by a filtered air supply. A bubbler or DAAMS tube will be used to sample this area to document nonexposure of personnel.

<u>Stack Monitoring.</u> The incinerator and filter exhaust stacks are the two main sources for agent to be emitted to the atmosphere from disposal operations. The primary purpose of agent monitoring in the exhaust stacks is to verify that the incinerators or filters are performing as designed. The secondary but equal purpose of agent monitoring in the exhaust stacks is to provide information in the unlikely event agent is emitted to the atmosphere. Process parameters such as pressure drop, flow rate and temperature are reliable indicators of process safety and performance (See Section 3). However, total dependence on these process control measurements is not sufficient when dealing with chemical agents. Taking into account the very low stack emission standards and the dilution of exhaust gases which takes place in the atmosphere, the agent monitoring system allows prompt corrective action to be taken prior to the release of agent concentrations which would result in harm to the environment, plant operators, or the general public.

Incinerator Exhaust Stacks. The Metal Parts Furnace (MPF), Liquid Incinerator (LIC), and Deactivation Furnace System (DFS) each have their own pollution abatement system (PAS) but share a common exhaust stack. The Dunnage Incinerator and its associated PAS use a separate exhaust stack. Both stacks are monitored continuously during furnace/incinerator operation by a Low Level ACAMS and a Bubbler or DAAMS tube. In addition to the stack alarm, the individual exhaust ducts from the MPF, LIC and DFS to the common stack are continuously monitored by a High Level ACAMS and periodically by a Low Level ACAMS. These monitors will be used to determine which incinerator/furnace is causing an upset condition in the event of an upset alarm at the common stack. The stack and duct alarms provide a secondary system to the process monitoring system for detection of process upsets. An alarm in this monitoring system will result in immediate cessation of waste feed to the incinerator. Corrective actions will be performed and verified before waste feed is resumed.

Filter Stack Monitoring. The seven filter (five primary, two back-up) banks used to remove any agent contamination from the ventilation air share one common stack. Each filter bank consists of two carbon beds, a primary and a back-up, to remove any chemical agent contamination from the air. Like the incinerator exhaust stack, the filter exhaust stack is monitored continuously by a Low Level ACAMS and a Bubbler or DAAMS tube. In addition, the space between the redundant carbon beds is monitored periodically by a Low Level ACAMS. If an upset alarm occurs in the filter stack, the filter bank causing the problem is taken off line (replaced by a backup filter bank) and the carbon beds of that bank are replaced.

Brine Dryer Stack. In addition to the incinerator and filter stacks, an exhaust stack is used to vent the steam from the Brine Dryers to the atmosphere. The Brine Dryers are used to dry the scrubber brine from the MPF, LIC, and DFS PASs into a salt which is disposed of by placement in an approved landfill. The potential for an agent emission from the Brine Dryer stack is very small because the brine is certified agent free before being dried. However, as a confirmatory measure, the Brine Dryer stack is continuously sampled with either a Bubbler or DAAMS tube.

2.6.5 Installation Perimeter Monitoring

2.6.5.1 Purpose

Installation perimeter monitoring is performed to indicate that no agent above the GPL has been released as a result of a CSDP activity. The purpose of the perimeter monitoring stations is not to control disposal activities or to provide an early warning of an accidental release; the chemical agent alarms used in the storage area and disposal plant will be used for this purpose.

In addition to agent monitoring, some of the perimeter monitoring stations will be used to collect meteorological data which is required to model an accidental agent release. Industrial pollutant monitoring, as prescribed by the Clean Air Act and as regulated by each state, will also be performed at these locations, in addition to the industrial pollutant monitoring performed in the incinerator exhaust stacks.

2.6.5.2 Methodology

At present perimeter monitoring is routinely performed at Tooele Army Depot, Utah and Lexington Blue-Grass Army Depot, Kentucky. Additional systems will be added before implementing any disposal alternative.

Either Bubbler or DAAMS tubes would be used at the perimeter monitoring stations to sample for the presence of the agent(s) being stored and processed. The Bubbler or DAAMS tubes would be collected every twelve to twenty-four hours and then analyzed at the installation laboratory. The installation operations center would be immediately notified of all confirmed positive results.

The number and spacing of perimeter monitoring stations necessary to surround the installation boundary around the relevant installation areas (i.e., the disposal plant and storage yard) would be determined for each installation on a site-specific basis. It is expected that six to ten stations would be required per installation. Each station would consist of a ten meter tower and an equipment enclosure. Each enclosure would be temperature controlled and would provide all the housing necessary to protect the instruments from the environment. Each station would have instruments to measure wind speed, wind direction, ambient temperature, and chemical agent, as well as industrial pollutants, as required.

Siting of the stations would be based on a review of predictions made by an atmospheric dispersion model using site-specific meterological data. It is anticipated that the stations would be located in a greater density in some directions such as the prevailing downwind direction from potential on-site sources and/or nearby population centers. The stations would also be located based on topographical considerations (and access to electrical power and roads).

2.6.6. Emergency Response Monitoring

2.6.6.1 Initiation of Emergency Procedures

The automatic chemical agent alarms used during the storage, handling, transport, and disposal of chemical agents and munitions (Sections 2.5.2, 2.5.3, and 2.5.4) will normally provide the first warning of a chemical agent release to the environment. Emergency procedures will be initiated immediately on receipt of the alarm and will consist, as a minimum, of the following action: (1) operators donning proper protective clothing; (2) visual confirmation of the alarm; (3) visual identification of the source and size of the release; and (4) corrective measures to control and/or eliminate the agent source. This information, in conjunction with the time and location of the agent release, and meteorological conditions, is used to model the agent release and to determine what additional agent monitoring and corrective emergency actions are required. The emergency preparedness/response program is discussed further in the report entitled, Emergency Response Concept.

2.6.6.2 Reentry Monitoring

In the unlikely event of a major lethal chemical agent release, the potential exists for contamination of property or resources outside of government control. At present, there are limited standards that can be applied to determine safety parameters for the public to use or inhabit such property and resources. These standards are the agent exposure limits described in Section 2.2. However, standards for other media must be developed. The Army is currently working with the DHHS and other appropriate agencies to develop such standards.

In the aftermath of an accidental major agent release, the Army and associated Federal, state and local agencies would work together under the general guidance of the Federal Emergency Management Agency to ensure that public health and environmental hazards are detected and eliminated. Monitoring will be a critical element of this effort. The Army, in conjunction with other government agencies, will provide technical expertise and equipment necessary to monitor affected areas and resources.

SECTION 3

PROCESS CONTROL AND MONITORING

3.1 INTRODUCTION

Each CSDP plant will have a process control and monitoring system that will allow the plant operators at remote locations to monitor automated equipment that will separate the explosives and agents from munitions. The explosives and agents will then be incinerated, and the munition bodies will be thermally detoxified. Each action will be remotely monitored through the process control system to ensure that no accidents or agent releases occur. The process control system will also monitor and control safety and process support systems. Information will be collected to make management decisions (e.g., shutdown decisions) and to provide historical data on the operation.

3.2 CRITERIA

To safely dispose of the chemical agent and munition stockpile and to protect the operators at the CSDP plants, it is necessary to minimize human contact with as many phases of the disposal process as possible. It is also necessary to minimize the amount of operator control of the disposal equipment to prevent accidents caused as a result of human error, repetitive actions or the loss of operator attention. For these reasons, a system has been defined that will allow the operators to remotely monitor the actions of equipment that will be automatically controlled.

The process control and monitoring system has not, however, been defined to operate completely independently of human control. Control system operators will be required to monitor the automatic actions of the process control system and to respond to upset conditions, if required. The process control system will be programmed to return the process to a safe condition, but it will be the control system operators' responsibility to ensure that those safe conditions are achieved. The functions of the control system and the control system operator are then defined as follows:

a. Primary control room operator functions are to:

(1) Initiate automatic operation of equipment when pre-conditions are met.

(2) Verify required performance of the control system when the plant is operating automatically.

(3) Prevent the occurrence of conditions that could cause unnecessary automatic shutdown.

(4) Control equipment in semi-automatic or manual control modes to support installation and maintenance activities.

(5) Isolate equipment failures or malfunctions that have caused

shutdown conditions to occur.

(6) Monitor and ensure the safety of personnel working in potentially contaminated areas.

(7) Coordinate all plant activities associated with munitions disposal, including those not performed in the Munitions Demilitarization Building.

b. Primary automatic control system functions are:

(1) Operate plant system equipment during automatic and semi-automatic control modes.

(2) Shutdown system operations when a condition exists that could jeopardize personnel or damage equipment.

(3) Alert control room personnel if measures from sensors exceed pre-alarm thresholds so that the operator action may be taken to avoid conditions leading to system shutdown.

(4) Provide control system personnel a simplified, concise presentation of the current status of the process and of the process equipment.

3.3. AGENT AND PROCESS MONITORING

The monitors or sensors used in demilitarization plant are used primarily to aid in the control of the equipment, to monitor the process and alert the control system operators of upset conditions, and to collect data for historical and maintenance purposes. The in-plant agent monitors described in Section 2.6.4 are companion devices designed to reliably and quickly signal the occurrence of a plant problem. Together these devices are designed to provide sufficient, timely information used to allow for the correction of upset conditions and to issue correct emergency response notifications, if required.

The process sensors work in conjunction with the process control system and can be configured to both monitor and control or just monitor the process as designated at design.

Signals from sensors used for monitoring are sent to the control system operator's console to be used for continuously monitoring a particular process condition. Pre-alarms and shutdown alarms will normally be assigned to these signals which will be used to alert the operator of a potential upset condition or that the system has been shutdown.

Signals from sensors used for control are sent to the process control system. The process control system will look at the deviation of these signals from the control setpoint and send signals to control devices to correct for these deviations. Signals from sensors used for control will also be sent to the control system operators console to allow the operator to continuously monitor a particular process condition. Pre-alarms and shutdown alarms will be assigned to these signals that will be used to alert the operator of potential upset condition or that the system has been shutdown.

Digital signals are normally generated by switches and are used mainly in the control of machines that perform a series of sequential actions. These signals will be used to alert the control system operator of a change in state of a field device and will be used to verify that a program step has been completed. Signals that indicate a malfunction in the proper operation of a machine will be alarmed.

The signals from in-plant ACAMS, described in Section 2, are treated as monitoring sensors. Process signals representing the agent concentration seen by the ACAMS are sent to the control system which, in turn, displays the signal on the operators' control system consoles. If agent concentrations that are above the alarm point are sensed, an alarm is initiated and the operator will immediately take corrective action for the equipment contributing to the agent release. The response will be under the direction of the shift supervisor and will follow emergency standing operating procedures (SOPs). The agent concentrations and the elapsed time during the ACAMS alarm will be recorded and printed for management and historical purposes.

Results from bubbler or DAAMS analyses will be entered into a computer terminal located in the laboratory that will transmit the information to the process data acquisition and recording computer. Management reports will then be generated and the data will be archived for historical purposes. Bubbler results that exceed predefined limits will be transmitted telephonically to the control system operators. The control system operators will take corrective action for the equipment contributing to the agent release. The corrective action will be under the direction of the shift supervisor and will follow emergency SOPs.

In-plant agent monitors are located at or near points of effluent discharge to the environment (e.g., the furnace stack), with additional monitors that protect plant workers by giving the earliest warning in the event of an agent release within the disposal facility. These sensors complement the process sensors by monitoring for the direct presence of agent. A more detailed discussion of in-plant agent monitoring is presented in Section 2.6.4.

3.4 PROCESS MONITORING AND CONTROL PHILOSOPHY

Selection of the sensor type and location and determination of how the sensor information would be used to monitor and control the process were the result of an in-depth analysis of each piece of process equipment. The steps followed in the analysis were as follows:

1. Define how each piece of equipment would function during normal operation.

2. Define the operating ranges of the process and the consequences if those ranges were exceeded.

3. Define the method of startup.

4. Define the method of shutdown.

5. Define the method of emergency shutdown based on the consequences developed in 2 above.

6. Define the interaction between pieces of equipment above.

Once the analysis of how the equipment functions was completed, the process parameters requiring control were determined. From this, sensors of proven dependability were selected and located in the process. Monitors were also selected to allow the operator to verify proper control of the process. Knowing the operating ranges of the process, pre-alarm points and shutdown alarm points were established.

For the equipment that operates sequentially, each step of the sequence was defined and digital sensors or switches were selected to confirm the completion of these steps.

In cases where sensor information is considered critical to process monitoring and control, backup sensors were specified. The process control system will compare signals from these sensors. If a deviation is detected, the conditions will be alarmed and operator will be required to take action to correct this deviation.

Other sensors were installed in the process that would allow for the gathering of routine data for maintenance and munition accountability purposes.

The governing concerns that dictated the rules of the analysis described above were as follows:

1. Prevention of the release of agent to the atmosphere.

2. Prevention of a munition detonation.

3. Safety of the workforce.

4. Prevention of the release of gases and particulate matter that do not meet Federal and state emission standards.

5. Control of hazardous waste leaving the plant.

6. Verification of complete detoxification of munition parts exiting the process.

7. Prevention of damage to the equipment.

Each system used in the disposal process required independent analysis to define its operation and sensors required for proper monitoring and control. Many systems were similar in function, and because of this, generalized logic applied to the operation and selection of sensors could be applied. A description of the incinerator systems and a discussion of sensor selection are provided below.

3.5. FURNACE SENSOR SELECTION PHILOSOPHY

Incineration has been selected as the most efficient and reliable means of disposing of agent and explosives in chemical munitions. Four incinerators will be used in the standard chemical demilitarization plant. Those incinerators and a description of each are as follows:

1. <u>Liquid Incinerator (LIC).</u> Agents removed from the rockets, projectiles, mortars and bulk containers will be pumped to the LIC for disposal. The agent will be injected into the LIC where it will be atomized and incinerated.

2. <u>Deactivation Furnace System (DFS).</u> Explosive, propellants and some munition hardware that is agent contaminated are fed into a rotary kiln where the explosives, propellants, and agent are incinerated.

3. <u>Metal Parts Furnace (MPF).</u> Metal components from munitions that have had the explosives and most of the agent removed and bulk containers with most of the agent removed are fed into the MPF where they are thermally detoxified.

4. <u>Dunnage Incinerator (DUN).</u> Noncontaminated and agent contaminated dunnage are fed into the DUN for incineration.

To ensure complete incineration of agent, it is necessary that the agent see certain temperatures for certain periods of time (i.e., residence time). The incineration systems described above are similar in function in that each is required to provide sufficient residence time at certain temperatures to ensure that agents are completely incinerated. Each system requires a means of shutting down to prevent agent from escaping during a process upset. Each system requires redundant burners to minimize process shutdowns due to nuisance flameouts of individual burners. Each system must be controlled, started, and stopped automatically and monitored remotely from the central control room. Additionally, each system will be monitored to ensure compliance with state and Federal emission standards. The residence time is a function of the size of the incineration system and the combustion gas flow rate, but the temperature is maintained through the control of the firing rate of the burners.

Temperatures are sensed by thermocouples located in the appropriate zones of the incinerators. The signals from the thermocouples are sent to controllers in the process control system. The controllers attempt to match the operating set point programmed by the operator. Deviations in temperatures from the set point causes the controller to send signals to the burner systems to either increase or decrease the firing rate in the zone to return the set point. If the deviation continues to the pre-alarm point, the operator will be alerted by the control system. The operator will have an opportunity to assess and correct the problem. If the deviation still continues to the shutdown alarm point, the process control system will immediately shutdown waste feed and, if appropriate, shutdown fuel feed to the burners. Feed will not resume until the system is restarted and at the required temperature.

Temperature sensing is considered critical to the operation of these incinerators, therefore, redundant temperature sensors will be installed in each zone requiring control. The signals will be compared in the process control system and deviations will cause the process control system to alert the operator.

Interlocking is provided to ensure that the incinerators are quickly shutdown when critical process conditions deviate from normal to prevent the release of agent, protect personnel or to prevent damage to the system. Critical parameters that deviate beyond shutdown alarm points will stop waste feed into the incinerators.

Loss of flame in all burners in the primary chambers will cause feed to stop. Loss of all burner flames in the afterburners will cause feed to stop, cause the primary chamber burners to stop and cause gas flow through the system to stop to contain all agent vapors. Loss of negative pressure and pushing the emergency stop button will have the same effect as the loss of all burner flames in the afterburners.

Most chambers of the incinerators contain multiple burners. The burners in each chamber or zone are controlled by one temperature sensor. The burner systems have been designed such that each burner in a zone is independent of the others and loss of one burner will not cause a shutdown of the remainder of the burners in that zone. Each burner is monitored by a burner management system approved for use by the National Fire Protection Association (NFPA). The burner management system, independent of the process control system, monitors the flames in each burner. Loss of flame in any burner will be sensed by the burner management system's flame detectors and the burner management system will stop fuel and air flow to that burner. The burner management system will also control the starting of each burner. If certain preconditions for starting burners are not met, the burner management system will not allow the burners to start.

Each incinerator will have oxygen and carbon monoxide sensors located to monitor for improper combustion in the furnaces. Deviations will be recorded and reported in accordance with Federal and state environmental regulations.

3.6 CONTROL SYSTEM DESCRIPTION

The process control system will consist of programmable controllers, network managers, operator interface subsystems and a data acquisition system.

The programmable controllers will be used to control specific plant equipment systems and are used to communicate the status of the processes to the central control room. These controllers will be distributed throughout the plant and will be located near the plant equipment that will be controlled. If process conditions deviate from normal programmed conditions, the programmable controllers will detect the abnormalities and transmit threat information to the central control room to alert the control system operators of pending malfunction. If process conditions continue to deviate, the programmable controllers will automatically shutdown the process to a safe condition and alert the control system operator that shutdown has occurred.

Each programmable controller has a redundant controller operated in parallel. If failure of the primary programmable controller is detected by the internal diagnostic system, an alarm will be annuciated in the console diagnostic alarm summary and the system will automatically switch to the secondary controller. If both programmable controllers fail, a communication error will be detected by the network manager and the controller output will maintain its last state prior to process failure and shutdown, as appropriate, would take place. Also, input and output signals will be continuously compared by the primary and secondary controllers. If a difference in signal is detected, the controllers will set the device being controlled to a safe condition and a signal will be sent to the control room to alert the control system operator of the condition.

The programmable controllers and process acquisition system will be linked together by redundant data communication links. The data communication links will pass data to and from other controllers, the process data acquisition system and the network manager.

The network manager will consist of redundant programmable controllers which will be used to manage the data flow between the other controllers, process data acquisition system, annuciation panel and the operator interface subsystems.

The annuciation panel will be used to provide additional information to the control system operators concerning plant support systems.

The process data acquisition system will receive and record selective data from the central process control system. The selected data will then be reduced to report format for historical and management purposes.

The operator interface subsystem consoles will be used by the control system operators to monitor automatic operations of the system, to provide control capability in case of system upset and to allow manual control of all equipment, if deemed appropriate by the shift supervisor. The operator consoles will be redundant in the control room such that if a problem occurs with one console, the operator can operate specific equipment from another console.

A printer will be employed in the control room to log all control system alarms and operator actions and will be used to record operator comments.

The control room environment will be carefully controlled; in addition to temperature and humidity control (primarily for protection of computer equipment), the room will be maintained at positive pressure with filtered air to provide protection against in-leakage of toxic fumes in the unlikely event of a chemical accident. This design feature ensures that the plant can be controlled and shutdown even under emergency.

An uninterruptable power supply (i.e., a battery system) will be provided to supply power to the process control system to allow for the retention of the programmable logic controller's memory in the event of a power failure. The uninterruptable power supply will also power instruments to allow some operator actions, if required, during power failures.

SECTION 4

WASTE STREAM MONITORING

4.1 REGULATORY BASIS FOR MONITORING

The Federal, state and local governments have enacted regulations to protect human health and the environment by controlling pollution of our air, water and land resources. These regulations include specific levels of certain pollutants that can be released to the environment. These levels are denoted pollution control standards. One aspect of monitoring involves verification that these standards are being met. The regulations also specify design and operating requirements for systems that produce environmental pollutants. Monitoring is also used to demonstrate that these requirements are adequately embodied in a plant's design or operational procedures.

4.1.1 Hazardous Waste Regulations

The United States Environmental Protection Agency (EPA) and state hazardous waste regulatory agencies have determined that chemical agents and munitions disposal operations must be conducted in compliance with the requirements of the Resource Conservation and Recovery Act (RCRA) and the associated state and local hazardous waste regulations. These regulations require a wide range of monitoring actions:

(1) Development of monitoring and waste analysis plans as part of the hazardous waste permitting process.

(2) Development of an approved pre-operational testing plan (i.e., a trial burn plan) to ensure proper operation of the incinerators and air pollution control systems prior to prolonged disposal operations.

(3) Conduct of the trial burn and regulatory approval of its results.

(4) Continuous monitoring of specific process parameters to ensure proper on-going operation of the incinerators.

(5) Intermittent monitoring of process effluents to ensure compliance with environmental standards.

Each element is discussed briefly below.

The hazardous waste management permits dictate the conditions under which the CSDP facilities will be designed, constructed and operated. The Army has initiated the CSDP permitting process by developing and submitting hazardous waste permit applications for all CSDP alternatives under consideration to the regulatory agencies. These applications provide the Army's proposals for compliance with the hazardous waste regulations including a detailed plan for process and effluent monitoring during the trial burn and normal operations. These plans are presently under regulatory review. The Army and the regulators will work closely to develop the final monitoring and trial burn plans. The monitoring requirements set forth in the RCRA permits will take precedence over the concepts presented in this document.

The trial burn is a preoperational system check that ensures that the incinerators and their pollution abatement systems operate properly and in compliance with the hazardous waste regulations and permit specifications. As such, the monitoring requirements during the trial burn far exceed those during any other phase of plant operations. During the trial burn, the incinerators must be shown to be in compliance with the following RCRA standards:

1. Particulate matter emissions must be less than 180 milligrams per dry standard cubic meter of gas emitted from the system when corrected to seven percent oxygen.

2. Hydrogen chloride (HCl) emissions must be controlled so that the rate of emission from each furnace is no greater than the larger of either four pounds per hour or one percent of the HCl in the discharge gas of each incinerator before it enters any air pollution control equipment.

3. The incinerator and its pollution abatement system must demonstrate a combined destruction and removal efficiency of 99.99 percent for each principal organic hazardous constituent (POHC) selected for the trial burn.

The POHC is a incinerator feed constituent selected to demonstrate that a furnace can adequately destroy the full range of hazardous wastes that it must process. For chemical agents, the standard 99.99 percent destruction efficiency, as specified above, is not considered by the Federal and state hazardous waste regulators to protect human health and the environment adequately. The regulators are currently investigating adoption of the ASC agent emission standards described in Section 2 in place of this standard. However, the destruction and removal efficiency cited above (i.e., 99.99 percent) will apply to non-agent POHCs that may be selected for the CSDP trial burns.

The hazardous waste regulators are required to approve the POHCs for the CSDP trial burns. POHCs are typically selected from 40 Code of Federal Regulations (CFR) 261, Appendix VIII, although other compounds are considered and sometimes selected. POHCs are selected to demonstrate the furnace combustion characteristics. They represent the composition and degree of difficulty of combustion of the various hazardous wastes that will be burned in the furnace. Regulators determine the degree of combustion difficulty on the basis of a material's heat of combustion, with low heats of combustion representing compounds that are relatively more difficult to burn because they cannot readily support combustion. Typically, the compound with the lowest heat of combustion is selected as a POHC. A notable exception occurs when such a compound is present in proportionately very low quantities in the waste feed to the incinerator.

The hazardous waste regulators have indicated that each agent and nitroglycerine (a propellant component) should be selected as POHCs. Thus, up to three separate sets of trial burns will be required at each plant since only one agent is processed in the CSDP facilities at a time. Additionally, the regulators have requested that agent simulants or surrogates be used to demonstrate furnace performance prior to the agent trial burns. The surrogates will be at least as difficult to incinerate as the agents and will simulate their particulate matter and HCl emissions characteristics.

During the trial burn and throughout normal operations, certain process parameters will be monitored continuously to ensure that the furnace systems are operating properly. These parameters will be specified in the RCRA permits and will include such items as temperature, pressure, and the like. The RCRA regulations require that the carbon monoxide composition of the furnace exhaust gas be measured continuously as a means of noting whether the combustion process is adequately destroying the hazardous waste. Additional process monitoring requirements would be specified on a case by case basis in the hazardous waste permits.

The hazardous waste regulations require testing of solid residues from the incinerators and other hazardous waste processing units. The specific testing program will vary on a case by case basis, but may involve waste characterization to determine whether the wastes are hazardous or to determine subsequent waste management practices. Residues generated in the disposal of wastes that are listed in the hazardous waste regulations are automatically considered to be hazardous waste, and the only characterization testing required is to determine waste composition and compatibility with other wastes. The characterization tests for residues from "non-listed" hazardous waste disposal classify the residues by considering four "characteristics" of hazardous waste, i.e., (1) corrosivity, (2) reactivity, (3) ignitability and (4) EPA Extraction Procedure (EP) toxicity (e.g., toxicity as measured by a waste's leachable heavy metal content). These tests typically involve chemical sampling and analysis and are described in detail in the RCRA regulations.

4.1.2 Air Emissions Control Regulations

The Clean Air Act and its amendments are the baseline for regulating gaseous emissions to the atmosphere. These regulations have been adapted to state-specific air pollution control regulations. As such, there is some variation in air emissions standards among states, even though the state gaseous emissions standards must be at least as stringent as the Federal regulations. The air pollution control regulations also include provisions to protect air quality in pristine areas, as well as to ensure that the air quality in specific areas of concern is not degraded below acceptable levels.

All eight states where CSDP facilities could potentially be constructed have been authorized by the Federal government to administer their air pollution control programs. These states will require registration of the CSDP facilities by way of air emission source permits. The permitting process is similar to that described above for hazardous wastes, and will include the development of monitoring plans and demonstration requirements.

The National Ambient Air Quality Standards (NAAQS) are applied to the ambient environment and denote the general air quality of an area. When the ambient concentrations of specific pollutants do not exceed the NAAQS, the area is denoted an attainment area. All of the areas where CSDP facilities may be constructed are designated as attainment areas, with the exception of Aberdeen Proving Ground which is located in a nonattainment area for ozone. The CSDP facilities must be designed so that their air emissions do not exceed the applicable ambient air quality standards (either the NAAQS or more stringent state standards). The NAAQS are listed in Table 4.1.

Sites located in attainment areas are subject to Prevention of Significant Deterioration (PSD) regulations. Any facility is subject to Federal PSD rules if it is classified as a major pollutant source. This classification is based on the type of facility and the emissions rate of regulated pollutants. Facilities such as the CSDP plants are denoted major pollutant sources if they have the potential to emit over 250 tons per year of any regulated pollutant. Current analyses indicate that PSD considerations will not apply at any CSDP site except, possibly Tooele Army Depot (TEAD). The TEAD site-specifc standards are presented in Table 4.2.

The New Source Performance Standards (NSPS) and the National Emission Standards for Hazardous Air Pollutants (NESHAPS) were promulgated to address release of specific hazardous pollutants to the atmosphere from specific sources. The regulated pollutants are not destroyed or generated in the CSDP, and the CSDP facilities do not include process systems that are covered by these regulations.

4.1.3 Toxic Substances Control

Regulations of the Federal Toxic Substances Control Act (TSCA) govern the incineration of specific toxic chemicals. The only chemicals in the agent and munition inventory that are regulated by TSCA are the polychlorinated biphenyl (PCB) species that comprise a very small fraction of the M55 rocket shipping and firing tube (40 CFR 761). TSCA requires that 99.9999 percent of the PCB contained in any solid material whose PCB concentration exceeds 50 parts per million be destroyed in the incineration process. However, due to the very low quantity of PCBs in the shipping and firing tube, it is not feasible to analytically measure 0.0001 percent of that amount in an incinerator combustion gas stream. The Army and the EPA are currently investigating alternative approaches to ensure that PCBs in the M55 rocket inventory do not adversely impact on the environment.

4.1.4 Water Quality Regulations

The Clean Water Act and the associated state water pollution control regulations govern the release of process waste water to the environment. The CSDP will not release process waste water to surface or ground water and hence is not subject to these regulations. Sanitary waste water will be released.

4.2 WASTE STREAMS TO BE MONITORED

4.2.1 Gaseous Emissions

The CSDP facilities emit gaseous wastes to the atmosphere from several sources including the incinerators, the building ventilation systems, steam boilers and the driers for the air pollution control system aqueous brine solutions. The extent to which each source of air pollutants is subject to the environmental regulations described in Section 4.1 is dependent upon its

TABLE 4.1

NATIONAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING TIME	PRIMARY STANDARD	SECONDARY STANDARD
Particulate	Annual (geometric mean)	75 ug/m^3	60 ug/m^3
	24 hour[a]	260 ug/m^3	150 ug/m^3
Sulfur dioxide	Annual (arithmetic mean)	80 ug/m^3	-
	24 hour[a]	365 ug/m^3	-
	3 hour[a]	-	1,300 ug/m^3
Carbon monoxide	8 hour[a]	10 mg/m^3	10 mg/m^3
	1 hour[a]	40 mg/m^3	40 mg/m^3
Ozone	1 hour[a]	235 ug/m^3	235 ug/m^3
Nitrogen dioxide	Annual (arithmetic mean)	100 ug/m^3	100 ug/m^3
Lead	Calendar quarter (arithmetic mean)	1.5 ug/m^3	1.5 ug/m^3

[a]Not to be exceeded more than once per year.

[b] Note: State governments can promulgate more stringent standards than those of the Federal government. The CSDP facilities will be designed and operated to meet the most stringent applicable air quality standards.

Source: 40 CFR 1

TABLE 4.2

MAXIMUM ALLOWABLE INCREMENTS UNDER PSD[a]

POLLUTANT	MAXIMUM ALLOWABLE INCREASE CLASS II AREAS (MICROGRAM/CUBIC METER)
Particulate matter	
Annual geometric mean	19
24-hour maximum	37
Sulfur dioxide	
Annual arithmetic mean	20
24-hour maximum	91
3-hour maximum	512

Source: 40 CFR 52.21

[a] Ambient environmental impact as defined by computerized dispersion modelling of particulate matter and sulfur dioxide emissions.

chemical composition.

Incinerator combustion gases are cleaned in pollution abatement systems prior to being emitted to the atmosphere. These pollution abatement systems are designed to remove pollutants in sufficient quantities to ensure that air emission standards are not exceeded. The incinerators themselves destroy agents and other POHCs to levels consistent with incinerator destruction efficiency standards and agent emission standards.

The incinerator emissions will vary depending on the materials being disposed of at any given time. Emissions from incineration of agent in the presence of excess air include significant quantities of nontoxic gases such as carbon dioxide, water, nitrogen and oxygen, as well as certain additional pollutants. Air pollutants from GB combustion include particulate matter, hydrogen fluoride, phosphorus pentoxide, carbon monoxide and nitrogen oxides. VX combustion produces sulfur oxides rather than hydrogen fluoride. Incineration of mustard produces hydrogen chloride, sulfur oxides, nitrogen oxides, carbon monoxide, and particulate matter.

The process steam and building heat boilers also produce air pollutants typical of any fossil fuel combustion process. The boilers burn fuel that contains sulfur, the combustion of which forms sulfur oxides. Control of this pollutant is achieved by the use of fuel with a low sulfur content, thereby eliminating the need for pollution control devices. The combustion of fossil fuel also results in the formation of small quantities of nitrogen oxides, carbon monoxide and particulate matter.

The building ventilation systems clean agent from the air that passes through the Munitions Demilitarization Building and the Laboratory. The system will operate continuously and will remove agent from the air to levels below the agent emission standards (i.e., the ASC) cited in Section 2. No other air pollutants will be discharged through the ventilation system.

The aqueous brine solutions from the incinerators' pollution abatement systems are dried. In doing so, water is released to the atmosphere in the form of steam. The major dissolved constituents of the wastewater are not volatile, and therefore would not be released as a gas to the environment.

A typical CSDP plant will process a wide variety of munition and agent combinations. The gaseous emissions will likewise vary substantially. Table 4.3 provides the maximum emission rates for criteria pollutants and agents from the CSDP facility. It is important to note that at any given time the emission rates of specific pollutants may be much lower than those listed in Table 4.3, since the values listed are the maximum emission rates for all munition and agent combinations. However, a single agent and munition type will be processed at a time.

4.2.2 Waste Water

The CSDP releases no waste water to the environment except sanitary sewage. All waste water is processed in the CSDP facilities. There are three sources of process waste water: (1) the incinerator's pollution abatement systems, (2) spent decontamination solution from cleanup of agent-contaminated

TABLE 4.3

SUMMARY OF A TYPICAL CSDP FACILITY'S ESTIMATED MAXIMUM POTENTIAL HOURLY EMISSIONS[a]
(lb/hr)

SOURCE	PARTICULATE MATTER	SO_2	NO_x	CO	NMHC[b]	GB	VX	MUSTARD
Process Steam	0.19	0.023	5.3	1.33	0.11	N/A	N/A	N/A
Building Heat	0.10	0.011	2.7	0.67	0.053	N/A	N/A	N/A
LIC	3.9	10.3	11.8	1.1	0.012	1.3×10^{-5}	1.3×10^{-6}	0.0013
MPF	1.9	1.1	4.6	0.53	0.023	5.4×10^{-6}	5.4×10^{-7}	0.00054
DFS	7.7	0.090	61.2	2.2	0.030	2.1×10^{-5}	2.1×10^{-6}	0.0021
DUN	2.7	0.00027	0.18	0.75	0.0012	1.0×10^{-5}	1.0×10^{-6}	0.0010
Ventilation System	N/A	N/A	N/A	N/A	N/A	7.6×10^{-5}	7.6×10^{-6}	0.0076
Facility Total	16.5	11.5	85.8	6.6	0.23	1.3×10^{-4}	1.3×10^{-5}	0.013

[a] The values listed are the maximum anticipated emission rates for each pollutant/source combination. These values represent the maximum pollutant emissions considering all munition/agent combinations. Under normal operating conditions a single agent/munition type is processed at a time. These values are representative of a plant with the same throughput as the JACADS plant.

[b] NMHC is non-methane hydrocarbons.

equipment, structures, and protective clothing, and (3) boiler waste water (i.e., boiler blowdown).

Waste water from the boilers is not discharged to the environment, but is used as makeup water in the incinerators' pollution abatement systems. The pollution abatement system waste water contains high concentrations of dissolved salts produced by the reaction of acidic gaseous pollutants in the incinerator discharge streams with a pollution abatement system brine that is basic rather than acidic. Particulate matter is also entrained in these solutions. The water is evaporated and released to the environment in vapor form, leaving the non-volatile salts for disposal as a solid waste.

Spent decontamination solutions contain products of chemical reactions of agent and salts. If dried in the same manner as pollution abatement system waste water, the spent decontamination solutions could potentially emit toxic pollutants to the environment along with the water vapor. For this reason, the spent decontamination solutions are burned in the Liquid Incinerator. The water vaporizes and is released to the atmosphere via the pollution abatement system, while the remaining constituents are burned to form gaseous emissions and nontoxic salts. The salts are collected in a water filled trench located below the bottom of the incinerator and are subsequently combined and dried with the pollution abatement system waste water.

Waste water from the boilers is not discharged to the environment, but is used in the incinerators' pollution abatement systems.

4.2.3 Solid Wastes

The incineration processes generate solid waste that is itself potentially hazardous. Ash is produced by all furnaces. This ash could potentially contain sufficient quantities of metals to be designated as hazardous waste on the basis of the EP Toxicity characteristic. The presence of agent or explosive in the ash would also cause it to be a hazardous waste.

The DFS includes a particulate matter collection device (i.e., a cyclone) that is primarily used to remove fiberglass particles (from the M55 shipping and firing tube) from the DFS exhaust gas before it enters the afterburner. This residue also could be designated as a hazardous waste on the basis of its EP Toxicity or due to the presence of agent or explosi s.

The DUN is used to burn wooden pallets and other materials that produce relatively high quantities of particulate matter when incinerated. This incinerator uses a unique pollution abatement system specifically designed to collect small solid particles from the exhaust gas. The system also includes a dry bottom quench system spray drier that collects gaseous pollutants in small droplets of a salt solution and subsequently evaporates the water, leaving behind the salt in solid form. The solid DUN pollution abatement system waste could potentially contain sufficient amounts of metals or other chemicals that would cause it to be hazardous waste.

The major solid waste generated by the incinerators is scrap metal from the munition bodies or the agent containers. Metal scrap that is visibly free of ash or residue and has been incinerated for 15 minutes at a minimum scrap metal temperature of 1,000°F, will not be considered a hazardous waste. This practice is consistent with the Army's position that material that has been incinerated for 15 minutes at a material temperature of 1,000°F is completely decontaminated, free of hazard and is safe for release for general use or release to the public. This standard has been used in past demilitarization programs under the oversight of the DHHS. The standard is presently under EPA review.

The dried pollution abatement system salts could potentially exhibit the characteristics of hazardous waste due to the presence of metals. In tests performed at the Army's prototype incineration facility (the Chemical Agent Munition Disposal System (CAMDS) located at Tooele Army Depot, Utah) the metal content of these salts was found to be sufficiently high to cause them to be classified as hazardous wastes. Table 4.4 provides the approximate composition of pollution abatement system salt major compounds.

The ventilation system filters will be agent contaminated and, hence, are a hazardous waste. They will be disposed of by incineration in the Dunnage Incinerator.

4.3 CSDP MONITORING REQUIREMENTS

4.3.1 Monitoring of Gaseous Emissions

As noted in Section 2, all gaseous emissions from the CSDP will be continuously monitored to ensure that agent is not released in quantities that would adversely impact on human health and the environment. The reader is referred to that section for further details on agent monitoring in the incinerator or ventilation system exhaust gases. It is important to note that the continuous monitoring of a POHC is far beyond typical RCRA monitoring requirements.

Monitoring requirements for other pollutants during normal plant operations have not yet been established. This is typically done during the RCRA and Clean Air Act permitting processes, wherein the state and local governments will determine the appropriate level of monitoring. The Army has submitted permit applications for all disposal options under consideration, and the regulators are in the process of reviewing these applications.

The incinerator exhaust gases are, however, to be continuously monitored during normal operations for carbon monoxide content. This monitoring is required under RCRA regulations to indicate proper operation of the furnaces. These monitors will be tied into the furnace control systems and are typically used to control the air/fuel ratio. In the event that excessively high carbon monoxide concentrations are measured in the exhaust gas (indicating that the combustion efficiency is far less than optimal), the hazardous waste feed to the furnace will be stopped. Unless a fuel hazard exists, the fuel will continue to be introduced to the furnace to ensure complete combustion of residual hazardous waste in the furnace. The control room operators will be warned of this situation by an alarm.

TABLE 4.4

APPROXIMATE COMPOSITION OF MAJOR COMPONENTS OF POLLUTION ABATEMENT SYSTEM SALTS

	CONCENTRATION (weight percent, dry basis)		
Component[a]	GB 8-inch Projectile	VX Land Mine	Mustard 4.2-inch Mortar
Na_2HCO_3	1.40	0.80	0.60
$NaSO_4$	--	49.10	54.10
Na_2Cl	--	--	45.20
$NaHPO_4$	74.90	49.10	--
NaF	22.30	--	--
$NaNO_3$	1.30	0.80	0.05

[a]Shows principal components. A review of the concentrations of the scrubber brines indicates the presence of metals in these salts.

[b]Salts illustrated are munition-specific, and vary with the munition processed.

The preceding discussions address gaseous emissions monitoring during normal operations. However, additional monitoring will be conducted during the trial burns. This includes POHC, particulate matter and hydrogen chloride monitoring required to demonstrate compliance with RCRA and state hazardous waste regulations, as well as any prescribed monitoring required to satisfy air pollution control authorities.

The LIC, MPF, and DFS share a common stack. A monitoring house is provided on the stack to allow sampling of the individual exhaust streams. Only the one incinerator is operated at a time during the trial burn. The dampers between the exhaust blowers of the other furnaces and the stack are closed to prevent dilution air from entering the stack. Emissions from the DUN are measured in its own separate stack.

Each trial burn is expected to last 1.5 to 2.0 hours. Three trial burns will be conducted for each applicable agent and agent simulant/surrogate for each furnace. During the trial burn a range of operating conditions will be evaluated. The following samples will be taken according to the noted schedule using the specified methods:

- Particulate matter, water and HCl, (as applicable): One sample will be taken over the 1.5 to 2 hour trial burn period using EPA Methods 5 and 13 (40 CFR 60.685, Appendix A) with caustic in impingers

- Nitroglycerine: One sample will be taken over the 1.5 hour trial burn using Modified EPA Method 5 (for the Deactivation Furnace only)

- POHC: Three to four 20-minute samples per trial burn will be taken for non agent POHCs (except nitroglycerine) using the Volatile Organic Sampling Train (VOST) System ("Protocol for Collection and Analysis of Volatile POHC's Using VOST, PB84-170042, Envirodyne Engineers Inc., St. Louis, Missouri, March 1984). Agent POHCs will be monitored using the ACAMS.

- Carbon Monoxide: Continuous monitors and EPA Method 10 (40 CFR 60.685, Appendix A)

- Carbon Dioxide, Oxygen: Continuous monitor and one bag sample taken with the particulate train for EPA Method 3

Monitoring of other pollutants during the trial burn will be defined in the environmental permitting process.

4.3.2 Waste Water Monitoring

There is no regulatory requirement to monitor waste waters processed within the CSDP facilities, although the Army intends to implement a monitoring program for the pollution abatement system waste water.

Each batch of the pollution abatement system wastewater will be analyzed for lethal chemical agent and pH. In the unlikely event that agent is detected in a batch of pollution abatement system waste water, two more samples will be taken and analyzed for the agent. If it is confirmed that agent is present, the waste water will be chemically treated to destroy agent (i.e., by neutralization of the acidic agents using a basic decontaminant) before it is thermally dried in the brine dryer.

The spent decontamination solution is not a hazardous waste and will not be tested. These solutions may contain very low levels of agent (parts per billion or non-detectable), if any. However, since the spent decontamination solution will be incinerated, analyzing it will not provide any useful information to the operation of facility, as it is primarily water, and it is not considered to be a hazardous waste.

Similarly, the boiler waste waters are not planned to be monitored. These wastes may contain EP Toxicity metals. However, they are comingled with the water used in the pollution abatement systems and are ultimately subject to monitoring as part of the waste water from those systems.

4.3.3 Incinerator Feed Sampling and Analysis

The lethal chemical agents will not be tested prior to incineration. These materials were prepared to Government standards and are therefore well characterized. It should be noted that the agents are not true waste products, but are instead well-defined chemical products that are being discarded. It has previously been demonstrated that bulk GB and VX can be destroyed to the degrees of 99.9999995+ percent and 99.999999 percent, respectively. Bulk mustard destruction efficiency should be in excess of 99.9994 percent.

The explosives, propellants and related components also will not be tested prior to incineration. These materials were manufactured and loaded into the munitions according to Government standards. Testing these materials will not provide any information that is not already known or that will assist in the management of these materials. Information gathered during previous pilot tests have demonstrated the ability of the DFS to adequately destroy these materials.

4.3.4 Solid Waste Sampling and Analysis

Process solid wastes will be monitored in compliance with RCRA requirements. Additionally, they will be analyzed for the presence of agent and, if agent is detected, will be thermally treated to ensure complete destruction of agent.

The pollution abatement system waste water will be dried to a solid salt that will be analyzed for EP Toxicity metals and reactivity. A sampling and analysis program will be implemented each time a new munition or agent is processed. The program will involve obtaining samples from the first 30 drums produced in a particular agent/munition processing run. Since the salts are relatively homogeneous, the distribution of each EP Toxicity metal concentration should not vary significantly (i.e., in statistical terms it is assumed to occur in a normal distribution). If the concentration of any metal exceeds the concentration levels defined in 40 CFR 261.24 (at a confidence level of 99 percent, 3 standard deviations), the waste will be classified as a hazardous waste due to the presence of that metal. The salt generated from the operation of the dryer will also be tested for reactivity. The specific tests for reactivity will include testing for the presence of sulfides, inorganic fluorides and agent. If any of the wastes are shown to be reactive due to sulfide or inorganic fluoride content, all wastes will be classified as reactive hazardous wastes. Wastes found to contain agent will be incinerated to destroy residual agent below detectable levels. Salts determined to be hazardous waste on other bases will be disposed of in an approved, commercial hazardous waste landfill.

The sampling approach described above for the salt will also be followed for the DFS, DUN, and MPF ash; the LIC salt/ash mixture; the DFS cyclone residue; and the DUN pollution abatement system residue. The only difference is that if lethal chemical agent is detected in any of the waste types, all subsequent containers will be analyzed for agent. Agent-containing wastes will be incinerated to reduce agent contamination below detectable levels. Corrective actions in incinerator design/operation will be taken, if such are warranted.

The ash and cyclone residue generated from the DFS will be tested for EP Toxicity metals, the presence of agent, explosives, propellants, and reactivity (sulfides and inorganic fluorides). The items being treated in the DFS contain EP Toxic metals and therefore the wastes generated from the incineration of these items may be hazardous. Testing the wastes for explosives and propellants will provide the operator additional information on the destruction efficiency of the incinerator as well as information that will be necessary for the further management of the waste. In the event the wastes are found to display hazardous waste characteristics, they will be disposed of in an approved hazardous waste landfill.

Ash generated in the operation of the MPF will be tested for the same parameters as the DFS ash with the exception of explosives and propellants that do not enter this furnace. The ash and pollution abatement system residue generated from the DUN will be tested for EP Toxicity metals and the presence of agent. Any MPF or DUN wastes found to contain agent will be incinerated to destroy the agent to non-detectable levels. Wastes found to be hazardous on other bases (e.g., EP Toxicity or reactivity) will be disposed of in an approved, commercial hazardous waste landfill.

The ventilation system filters will not be tested prior to their disposal. These items will be disposed of in the DUN and physical/chemical analyses of the feed stock will not provide useful information to the management of these items.

Scrap metal decontaminated by the Army approved methods is not considered to be a hazardous waste and will not be monitored.

SECTION 5

ORGANIZATIONAL MONITORING

5.1 INTRODUCTION

The Program Executive Officer - Program Manager for Chemical Demilitarization (PEO-PM Cml Demil) is responsible for planning and executing all facets of the CSDP. The PEO-PM Cml Demil has established a variety of management controls, in addition to existing general administrative controls imposed by the Army and Department of Defense (DOD), to ensure the safe and timely execution of the CSDP. Management controls will be invoked for all phases of the program.

Due to the national scale and diverse nature of the CSDP, the PEO-PM Cml Demil will draw on the resources of a variety of organizations to execute the program. Considering the hazardous nature of chemical agent operations, a variety of regulatory and oversight agencies will provide additional management controls on the CSDP. This section addresses these management and administrative controls.

5.2 MANAGEMENT STRUCTURE

The PEO-PM Cml Demil will execute the CSDP and will draw on Army and DOD elements to provide necessary technical and administrative support. The PEO-PM Cml Demil will manage any planning, testing, design, construction, operation and closure activities required for the CSDP. Much of this work will be conducted by contractors or other government agencies under the direct management and technical direction of the PEO-PM Cml Demil.

The CSDP disposal facilities will be designed and constructed by contractor organizations. It is envisioned that the major disposal plants will be operated as government-owned/contractor-operated (GOCO) facilities. Each contractor's activities will be under the direct control of a government contracting officer. The contractors will be selected based on a number of factors such as their capabilities and experience with similar environmentally sensitive, toxic material handling and disposal programs. The contractors' main performance objectives will include quality of testing, engineering, design, construction, and operations, as well as safety. Project cost and schedule will be less critical, albeit important, considerations. The contractors' day-to-day performance during construction and operations will be measured by on-site Army monitoring teams. Plant performance will be documented with reports both internal and external to the Army.

All plant operating data collected by the operating contractor will be provided to the Army for review. These data will be presented to the Army in specific reports consistent with technical reporting requirements for the plant. The purpose of the reports is to ensure that operations are conducted within the control limits of established plant operating parameters; to assess process safety and performance; and to satisfy all regulatory requirements for data reporting. Plant operations reports containing relevant data will routinely be made available to appropriate regulatory agencies, to organizations with oversight functions, and to chain-of-command military organizations.

Throughout the life of the CSDP, plant design changes will be controlled by a centralized Army Configuration Policy Board consisting of senior managers to ensure that all design changes promote CSDP safety and environmental compliance in a cost effective and timely fashion. Recommended design changes will be reviewed by the Configuration Policy Board and, if approved, will be issued to all CSDP plants for implementation as appropriate. The Army will use the board to ensure that all plants operate in a safe and environmentally sound manner throughout their life cycle.

On-site reviews will also be made by organizations within DOD, including the DOD Explosives Safety Board (DDESB) and Surety and Operational Inspection (SOI) teams from the U.S. Army Materiel Command. Inspections will also be conducted periodically by inspection teams from the major subordinate command having authority over the installation at a particular CSDP plant site. These inspections will assess effectiveness in the areas of disposal operations, safety, security, surety and chemical accident response and assistance.

In the event that lethal chemical materiel must be transported to a national or regional disposal center, the transport operations will be subject to significant management controls. The PEO-PM Cml Demil will be assisted by the Military Traffic Management Command (MTMC) and the Military Airlift Command (MAC), who would provide significant assistance in surface and air transport, respectively, should a collocation alternative be selected. MTMC would contract with commercial rail carriers to implement a rail transport option, or would obtain an ocean going vessel from the U.S. Ready Reserve Force should marine transport be implemented. MTMC would execute the initial planning of all surface movements. MAC would perform a similar function in terms of arranging for air transport of chemical material, if such is required.

A central command and control office will be established to provide a centralized point of contact during the munition movement operations. All communications to the munitions carrier(s) will originate from this office upon approval by the officer in charge of the Command and Control Unit. The duties of the Command and Control Office will be as follows:

o Functioning as the primary communication link during movement of munitions;

o Receiving communication checks and status reports on movements of chemical munitions;

o Relaying reports and information to participating and supporting organizations and;

o Providing current information on status of normal and emergency operations to supporting and participating organizations.

5.3 REGULATORY AND OVERSIGHT MONITORING DURING NORMAL OPERATIONS

The DHHS maintains oversight of all lethal chemical agent operations, as mandated by PL 91-121, PL 91-441, and PL 99-145. As such, DHHS will review all demilitarization plans. It also will review and approve agent emission standards. The Army will provide all requested transport or plant operating data to DHHS for review.

The Army is responsible for ensuring that appropriate design and operating data are provided to the local, state and Federal regulatory agencies as stipulated by the environmental permits. The Army monitoring staff will include environmental professionals to monitor the operating contractor's data gathering activities and to ensure compliance with environmental requirements. The environmental regulatory agencies will also review these data to ensure that the CSDP facilities are complying will all applicable environmental laws and permit requirements.

On-site inspections will be conducted by the EPA, DHHS, and state environmental regulatory agencies. The objective of these inspections will be to make independent checks of CSDP plant operating performance.

5.4 TRAINING AND TESTING

Development of operator competence through training and practice is a keystone of safe CSDP plant operation. The training program will be in accordance with a detailed Training Plan which identifies knowledge and skills required to safely handle and transport munitions, as well as to operate the disposal plants. The training program will cover personnel safety, agent release prevention, decontamination procedures, hazardous operations, emergency response and contingency plan implementation, as well as normal munitions handling, transport and disposal operations and maintenance procedures.

Training will consist of classroom instruction; hands-on practical exercises using actual handling, transport or plant systems equipment; and on-the-job training before the start of agent operations. A central training facility will be constructed to provide a uniform training program. The central training facility will be used for some classroom and hands-on training and will incorporate actual and mockup process equipment. A simulator will be used for control room training. Additional classroom and on-the-job training will be conducted at each chemical operations location. Operator training for response to failure and emergency conditions will be specifically included in the training program. Prior to the start of operations, there will be a period of Integrated Systems Training (IST) during which all plant and transport systems will be operated under mock conditions with simulant munitions (without the presence of agent) as a unit under both normal and emergency conditions. This provides both checkout of equipment and practice for operators. During Integrated Systems Training, failures will be initiated and operating personnel will be evaluated on their response to systems failures or problems. At the conclusion of the plant checkout period, the Army will conduct a formal preoperational survey to ensure that all safety and environmental requirements are met before any operations involving agent are begun. As part of this survey, an independent team will visit the site and evaluate operator response to systems failures a final time before agent operations begin. Laboratory and quality control (QC) personnel will operate and test their equipment and procedures until the QC requirements for precision and accuracy are met.

Each person will be given initial training when hired and/or assigned to the demilitarization facility work force. Refresher training, including that concerning agent characteristics, symptoms, first aid, and contingency plan procedures, will be conducted every 6 months, or whenever process changes or agent type changes occur. Operations and maintenance training will be conducted whenever significant process changes are implemented. The training courses will be tailored to the specific workload.

Approximately 9 months of extensive plant testing will be conducted before toxic operations to verify the performance of all control systems and equipment, including: (1) control loop checkout, (2) calibration of all instrumentation, and (3) performance testing of control systems and equipment without agent.

5.5 SAFETY REVIEW SYSTEM

Throughout the period of CSDP planning and plant design, independent internal Army safety reviews will be conducted to ensure that the design of individual systems and the overall plant is consistent with established safety requirements. Reviews of both plant and transportation operations plans will also be conducted. The formal studies which will be prepared to document the safety review process include a Preliminary Hazard Analysis (PHA), a System Hazard Analysis (SHA), and a Safety Submission.

The purpose of the Preliminary Hazard Analysis is to ensure that potentially hazardous system failures are identified and design changes are recommended early in the plant design. The Preliminary Hazard Analysis will be conducted early in the design effort.

The SHA will use various safety analysis techniques to identify risks and recommend corrective measures. The SHA should coincide with completion of the conceptual design for the plant, which is the 35% design point.

The Safety Submission provides a written record of documentation on plant safety design features and on regulatory compliance. This document is prepared in accordance with Army Regulations and DOD Safety Standards. Provided at the 60% design point, it is formally reviewed by numerous Army safety organizations, including the Department of Defense Explosives Safety Board. Approval of this document is a prerequisite to preparation of the final (100%) design.

At the conclusion of design, a System Safety Analysis Report (SAR) will be prepared. This report will (1) summarize the design features of the plant, and (2) present a complete quantitative hazard analysis of the total demilitarization system including hardware, processes, procedures, and both subsystem and man-machine interfaces in the normal operations mode and in contingency or emergency modes.

Throughout the design, general and topical safety reviews of design submittals will also be performed by DOD safety groups having particular expertise, (e.g., the DDESB for explosives and chemical safety, and the Army Materiel Command Field Safety Activity (FSA), for all aspects of explosives, chemical and industrial safety).

5.6 EMERGENCY PREPAREDNESS

At each CSDP installation, there will be an operations center. The operations center is responsible for control of agent operations and will be manned at all times with an individual specifically authorized to act immediately in matters of emergency response. At each agent operations site, designated operating personnel are given on-site responsibility for maintaining communications with the operations center on the status of operations. For munitions storage, communications are maintained between the guard force and the operations center.

The operations center will be responsible for implementing all CSDP emergency response procedures. A Contingency Plan will be established for each CSDP plant as provided under provisions of the RCRA (40 CFR 270.14). An installation wide Chemical Accident/Incident Response Plan will also be in place at each site. In the event of a release of hazardous material, a specific sequence for notification and reporting the release to civilian emergency response agencies will be followed. Additionally, in accordance with Army Regulation (AR 50-6), chemical accidents or incidents will be reported within 3 hrs of detection to the Army Operations Center (AOC) at the Pentagon, and an electronically transmitted message will be sent to the AOC within 24 hrs of the accident.

5.7 INDEPENDENT MONITORING

Independent review of the Army's operational data will be conducted by DHHS, EPA, and the appropriate state regulatory agencies.

The authority for independent monitoring has been clearly delineated. DHHS is specifically empowered to exercise substantial review responsibilities for environmental permitting and review will be conducted under mandate of applicable federal and state laws. The states are responsible for air quality review and permitting, and all states (except Alabama) currently having primacy for RCRA permitting. The DHHS, EPA, and states with primacy will routinely receive reports from the operating plants and will have unannounced access to the plant(s) for inspections.

If these regulators were to decide to implement a monitoring program to independently evaluate the performance of a plant equipment or to validate the Army's environmental monitoring program, the Army is prepared to cooperate fully. The particular form of the cooperative effort between the Army and an independent environmental monitoring organization would be site-specific and would depend on the information needs of the independent organization(s).